

CREWSTATION ASSESSMENT OF REACH

AS APPLIED TO

THE OH-58A HELICOPTER

Michael Gregory Genetti

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# CREWSTATION ASSESSMENT OF REACH AS APPLIED TO THE OH-58A HELICOPTER

Michael Gregory Genetti

A Thesis
Submitted to
the Graduate Faculty of
Auburn University
in Partial Fulfillment of the
Degree of
Master of Science

Auburn, Alabama December 13, 1984

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Michael Gregory Genetti

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#### VITA

Michael Gregory Genetti, son of Albert Joseph and Marguerite (Trapolino) Genetti, was born on March 1, 1953, in Washington, D.C. He attended public and private schools in various states and graduated from DeMatha Catholic High School, Hyattsville, Maryland, in 1971. In July, 1971, he entered the United States Military Academy, West Point, New York, and received the Degree of Bachelor of Science (General Engineering) in June, 1975. For the next eight years he served in various assignments in both the continental United States and Europe. He received the degree of Master of Science from the American Technological University, Killeen, Texas, in December, 1982. He entered the Graduate School, Auburn University in June, 1983. He married Lori, daughter of Robert Wills Sandercock and Ann (Ross) Van Wert in November, 1979. They have a son, Michael Gregory, Junior, and a daughter, Ann Elizabeth.

#### THESIS ABSTRACT

# CREWSTATION ASSESSMENT OF REACH AS APPLIED TO THE OH-58A HELICOPTER

Michael Gregory Genetti

Master of Science, December 13, 1984 (Master of Science, ATU, 1982) (Bachelor of Science, USMA, 1975)

136 Typed Pages

Directed by Bruce E. Herring

A computer evaluation program, Crewstation Assessment of Reach (CARII), was utilized to determine the effectiveness of an evaluation designed for a single person workstation on a two person workstation. The workstation chosen for evaluation was the U.S. Army Helicopter OH-58A. To compensate for the multiple person workstation, the cockpit was defined from three points of view as follows: the pilot while flying, the copilot while flying and an observer in the copilot's station. Through an internal mechanism in the CAR program, a sample of link-men was generated from the means and standard deviations of twelve anthropometric measurements from the data of the 1970 survey

of U.S. Army aviators. These link-men were then evaluated for their accommodation to the 24 controls defined in the workstation. Through the example of the relocation of one control, it was demonstrated that an evaluation tool such as CAR should be utilized in the design process.

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#### I. INTRODUCTION

Statement of the Problem

The problem of this study was to determine the effectiveness of the design of a two-person (shared) workstation by using a computerized evaluation method designed to evaluate the percent population accommodated by a single person workstation.

#### Hypotheses

The hypotheses of this study are as follows:

- 1. By treating each operator location separately, the evaluation will determine the percent of the population accommodated exactly as if it were a single person workstation.
- 2. By 'weighting' the importance of each of the operators stations, the optimal design of the shared workstation can be determined.

Background and Introduction of the Study

Over the past 30 years, physical anthropologists have been concerned with the documentation and description of human body size variability and its application to design. A significant problem continues to exist, however, in the communication of such Knowledge to the wide variety of potential users, the design community. (Panero and Zelnick, 1979)

Thus begins the Foreword by Dr. John T. McConville to Panero

and Zelnick's <u>Human Dimension and Interior Space</u>. Dr. Mc—Conville goes on to mention that one member of the design group that needs this important knowledge is that of air—craft cockpit designers. Woodson and Conover (1964) state that applying human engineering in design is not an exact science. They warn against considering the designer as an average person or as the representative of the population that will use the device. Panero and Zelnick (1979) point out that designing for the average is poor in that there really is no 'average man'. They say that a man average in stature may not be average in weight, sitting eye height, etc. In fact, those men average in any four anthropometric measure categories are less than 2% of the population total.

Due to the researcher's military flying experience, the particular shared workstation examined will be that of the OH-58A observation helicopter cockpit. The need to include human engineering in the military cockpit design task was seen at least 30 years ago. This occurred when the North Atlantic Treaty Organization (NATO) Advisory Group for Aeronautical Research and Development held a symposium in the Netherlands entitled "Anthropometry, Human Engineering and Related Subjects." From this symposium came papers with such titles as "Body Measurement in Relation to Work Spaces in Aircraft" and "Adapting the Aeroplane to the Pilot" (AGARD, 1955). Even earlier than that, Fitts and Jones (1947) analyzed factors contributing to "pilot-error"

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experiences, among them the inability to reach controls while operating the aircraft. The problems existing in aircraft cockpits have been recognized for years, but unfortunately some problems still exist. The need to examine military cockpits, in particular helicopter cockpits, for optimal design is readily apparent.

In addition to designing a cockpit based strictly on body dimensions, the factor of internal stress of the operator while performing in varied environments must be taken into consideration. Verdier (1960) breaks down internal stress into two factors: physiological or physical stress and psychological stress. When considering the possible wartime scenarios in which the Army aviator may be found, both physiological and psychological stress could be at very high levels. If the aviator is to perform the many assigned missions, the act of flying an aircraft must be nearly 'second nature'. A properly designed cockpit with displays and controls optimally located which permits the crew to function together as a team is essential.

#### Significance of the Study

The significance of this study is that it will demonstrate to both designers and users of helicopters that computer based evaluation procedures exist that, although not
designed for the shared workstation, can and should be used
in the design process to determine what percentage of the
user population can fit into and perform the required

functions in the cockpit. Through the use in the design stage, users will not be forced to adapt to a poorly designed final product.

#### Definition of Terms

OH-58A: An OH-58A (Figure 1) is a four seat aircraft made by Bell Helicopter that is used mainly in scout and command and control modes.

Cyclic: The cyclic is a main flight control gripped by the pilot's right hand. It provides input to the main rotor disk allowing for hovering, forward, sideward or rearward flight. The cyclic control handle contains switches for the intercom, radio transmission, and force trim interrupt.

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Collective: The collective is a main flight control gripped by the pilot's left hand. It provides input to the angle of attack of the main rotor blades, giving upward and downward movement to the aircraft. The handle of the collective is the throttle. Located on the collective are also the starter switch, and the landing light on/off switch.

Antitorque pedals: The antitorque pedals are foot controls that adjust the pitch angle of attack in the tail rotor system. In hovering flight the antitorque pedals provide directional control while in flight they help to 'trim' the aircraft.

Overhead console: The overhead console is a 'ceiling' panel located between the pilot and copilot containing



Figure 1. OH-58A Helicopter

the circuit breakers, battery switch and assorted other switches (heater, defog and vent, etc.).

Proximity Warning Device (PWD): The proximity warning device is a device located on the main instrument panel that will alert the pilot of other aircraft similarly equipped that are within up to 300 feet above or below and up to 3000 feet radius. The warning is in the form of an audio alert and flashing lights with the following possibilities: Intruder is above, above/equal, equal, equal/ below, or below in altitude in relation to the aircraft position.

Very High Frequency (VHF) Radio: The VHF radio is a two way radio used for air-to-air and air-to-ground communications. The control head is located on the main instrument panel.

Frequency Modululation (FM) Radio: The FM radio is a two way radio mainly used for air-to-ground communication, especially to maintain contact with ground combat units. The control head is located on the instrument console between the pilot's and copilot's seats.

Interphone Control Panel: The interphone control panel is a panel to allow the pilot/copilot to monitor radio(s) desired and select to talk on the intercom system or one of the radios. There are two interphone control panels located on the main instrument control panel.

Ultra High Frequency (UHF) Radio: The UHF radio is a two way radio used mainly in an air-to-air communications role. It is usually located centrally on the main instrument control panel.

Transponder: The transponder is an active radar device that sends out codes to radar receivers so that the position of the aircraft can be monitored from the ground.

Together with an appropriate altimeter, the aircraft's altitude as well as position can be monitored. The transponder is located on the instrument console.

Automatic Direction Finder (ADF) Receiver: The ADF is a radio receiver that is used as a navigation aid. A needle located on the radio bearing indicator will point toward the transmission station of the frequency received by the ADF receiver. The ADF receiver is located on the instrument console; the radio bearing indicator is located on the main instrument panel.

#### Literature Review

In conducting the review of literature, the researcher confined the search to design of workstations,
particularly aircraft cockpit workstations, and evaluation
of workstation designs, especially computer aided evaluations.

It was particularly interesting to note that controversies involving the layout of the helicopter cockpit discussed in excess of 30 years ago are still being

discussed today. The record of "The Symposium on the Operation and Design Requirements of Helicopters" (Technical Secretariate, International Air Transport Association (IATA), 1953) listed these controversies. One question to be resolved was whether one pilot, two pilots or a pilot and an observer are necessary to safely fly passenger missions. The decision of those in attendance was that as far as design considerations were concerned, the requirement existed for dual flight controls because of training and crew checks. Additionally, the cockpit should be designed so that the aircraft can be flown equally well by one pilot alone. Along these same lines, a controversy existed over whether the captain's seat should be on the right side or the left side of the aircraft (in fixed wing aircraft, the captain sits on the left side; the reverse is true in helicopters). A representative from Sikorsky Helicopter mentioned several historical reasons for the captain's seat being on the right: 1) for weight and balance purposes, especially when flying solo; 2) early aircraft tended to tip over to the left and 3) early configurations had 2 cyclic controls but only one collective control which was located between the two seats. Because of this configuration, most pilots chose to fly in the right seat to be able to grasp the cyclic with the right hand and the collective with the left hand. A representative of the Gyrodyne Company of America (Technical Secretariate, IATA, 1953) went on to explain that a pilot sitting in the left

seat of a helicopter with dual controls will have to either switch hands (grasp the cyclic with the left hand) and tune radios with the right hand or cross the left arm over the right to tune the radios; neither solution was seen as feasible.

Shapiro (1955) gave actual figures for what he considered maximum displacements for the main controls: the cyclic - 16" in fore and aft movement, 12" in sideward movement; the antitorque pedals - 8" movement; collective pitch - 18" from top to bottom. Additionally, Shapiro (1955) presented a standard display arrangement for grouping of flight and engine instruments, which was, incidentally, the same as presented by the British Ministry of Supply (Techincal Secretariate, IATA, 1953). Murphy (1960) gave as one of the principles for the design of a workstation that the physical characteristics of the probable user population be considered in the design phase. He continued, "Compromise in optimum design for operator performance is sometimes necessary, however, due to such considerations as cost, availability of components, and weight and space limitations" (Murphy, 1960). In accepting less than the optimum, a couple of the implications are that the design may be hazardous or that it may cause discomfort to the operator (Murphy, 1960). Perry (1971) connected poor design and layout of the helicopter cockpit to pilot fatigue, a possible extension of the discomfort mentioned by Murphy.

Murphy (1960) was the only person who mentioned an aspect of the layout of a workstation that is critical, especially in an aircraft cockpit. That is the area of design for the ease of maintenance.

Bullock (1974) discussed the importance of designers of driver's compartments and aircraft cockpits having the availability of data representing the functional reach of the potential user population. She continued, "For example, in a cockpit, it is important that all pilots be able to simultaneously to reach the pedals, use the control wheel correctly, see through the windscreen and manipulate the manual controls while restrained by an adequate harness\* (Bullock, 1974). The need was demonstrated the following year (Bittner et al., 1975) for the development of an accommodated percentage model to evaluate aircrew cockpit design. Designers had well learned to design for 5th and 95th percentile users, but it was demonstrated that a large percentage of users were not accommodated by the designs. Later that same year, Bittner (1975) illustrated the use of a baseline Computerized Accommodated Percentage Evaluation (CAPE) model for cockpit analysis. The CAPE model and similar models made use of 'link men'--links representing parts of the body. Krause and Kremer (1973) discuss one such model named COMBIMAN (COMputerized Blomechanical MAN-model) and the applications of its use in evaluation workstations.

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In the design arena, Bonney and Williams (1977) discuss the use of Controls and Panel Arrangement by Logistical Evaluation (CAPABLE). Through CAPABLE, Bonney and Williams try to minimize an objective function such as distance traveled by positioning "n" controls into "m" possible locations. CAPABLE also uses a weighting factor referred to as 'prominence' to help determine the optimal layout. Bittner (1978) used the CAPE model developed for aircraft cockpits and made the logical extension to the driver's station in the automobile. Aviation Week and Space Technology (1984) reported that because of advances in the technology of avionics, helicopter cockpits are being totally redesigned. Some of the latest changes are vertical scale instruments (instead of round gauges), visual display units, and a single control head for all radio tuning requirements. One company is working on a computer voice entry system. The system would allow the pilot to tune radios, tune the ADF, change transponder codes, call up displays, and enter and recall navigation data. Once this system is operational, one would not have to worry if the aviator population could make many reaches!

### Scope of the Study

This study will be limited to the standard OH-58A aircraft as delivered by Bell Helicopter to the Army. The population against which the cockpit dimensions will be tested is that as generated as sample populations from a

Monte Carlo Simulation module that is a subroutine used in the computer evaluation package. The samples are generated from the means, standard deviations and correlation matrix from 12 anthropometric measurements taken from Technical Report 72-52-CE entitled "Anthropometry of U.S. Army Aviators – 1970". The measurements used to define the cockpit were taken from literature from Bell Helicopter and from actual measurements made by the researcher. Any conclusions drawn or recommendations made will pertain only to the OH~58A aircraft. Further, any recommended movement of controls or displays will not have been checked for feasibility, i.e. if the move would be cost effective or if the aircraft would remain within weight and balance limits.

#### Basic Assumptions

The basic assumptions of the study are as follows:

- 1. The design data for the cockpit definition are indeed what one would find in a standard OH-58A aircraft.
  - The measurements taken by the researcher are accurate.

- 3. The Design Eye Point (DEP), although not specified for the OH-58A aircraft, would be in the same position as that specified by the OH-58D aircraft specifications.
- 4. While flying the aircraft, the pilot/copilot will release his left hand from the collective to make any adjustments to controls regardless of the direction of the reach.

- 5. While observing from either the pilot's or copilot's station, the non-flyer will make adjustments of controls as necessary with the hand closer the control in question.
- 6. The main flight controls will be considered primary controls. All other controls used to define the cockpit will be considered secondary controls.
- 7. All reaches to controls will be attempted with the shoulder harness in the unlocked position.
- 8. The generated population samples are truly representative of the Army Aviator population in 1970.
- 9. The crewstation as defined by the researcher is a truly accurate representation of the actual OH-58A aircraft.

Procedures for Collecting Data

Most of the data collected came directly from computer printouts of the results of the accommodation analysis. The data used to define the population came directly from the anthropometric survey of army aviators in 1970. The crewstation definition data came from design specifications from Bell Helicopter and from measurements made on an actual OH-58A aircraft. Standard measuring equipment was utilized.

# II. THE CREWSTATION ASSESSMENT OF REACH (CAR-II-A) EVALUATION PROGRAM

#### Introduction

Through discussions with Dr. Stephen Morrissey, Dr. Alvah Bittner, Dr. Floyd Glenn and Commander William Moroney, the researcher decided to utilize a computerized evaluation tool known as Crewstation Assessment of Reach (CAR). A computer tape of the CAR program along with Technical Report 1400.06B entitled "CAR-II-A Revised Model for Crewstation Assessment of Reach" were provided to the researcher by Dr. Floyd Glenn of Analytics, Inc., in Willow Grove, Pennsylvania. The first task of the researcher was to adapt the CAR program, written in FORTRAN 77 for a CDC computer system, to the IBM mainframe system at Auburn University. Additionally, the structure of the program had to be changed from a flexible interactive mode to a strictly non-interactive mode.

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The CAR program is broken down into four basic functional areas as follows: input of operator data, input of data to define a crewstation, performance of an accommodation analysis, and development of a reach envelope. Each of these four areas will now be discussed.

#### The Operator Sample Option

The logic flow of the operator sample option is shown in Figure 2. The user is given the option to generate an operator sample or to enter actual measurements of operators that are to use the crewstation. The researcher chose the option to generate a sample, so that option will be further explored. When choosing the generate option, the user is given a menu with the six options as shown in Figure 2. Each of these options will now be discussed.

Option number one is the place most users would start. This option is the input option where the user is required to input the means and standard deviations of twelve anthropometric measurements from the population that will be used in the accommodation analysis. The twelve anthropometric measurements are listed in Figure 3. Depictions of these measurements are shown in Appendix A. In addition to the twelve pairs of means and standard deviations, the correlation matrix involving these twelve measurements must be entered.

Option number two is the edit option. This option allows the user to correct entries made in an existing operator file. A print function is also included with this option so the user can check the entries.

Option number three, the save option, is self explanatory. This option allows the user to save the input data on file for use in the accommodation analysis.

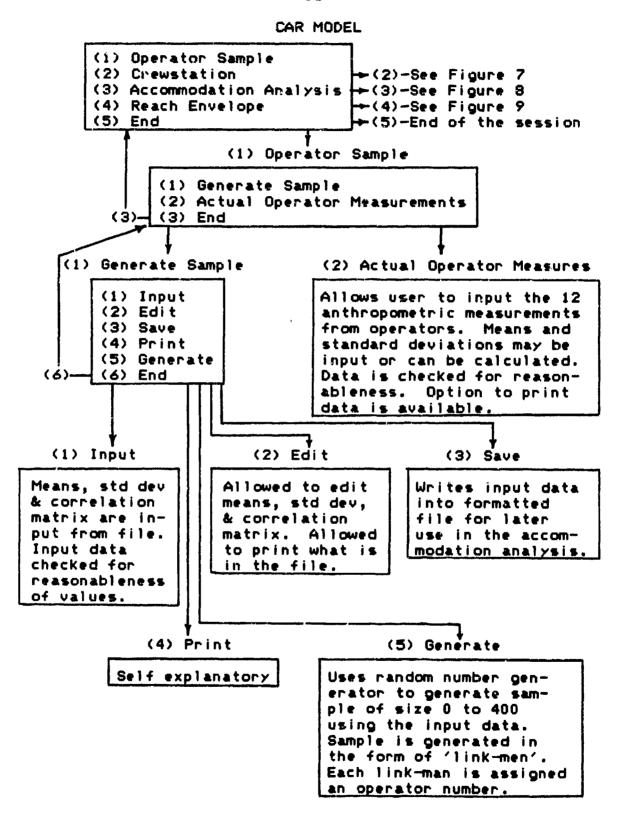


Figure 2. Operator Sample Option

M1=Stature M7=Shoulder-Elbow Length
M2=Waist Height M8=Forearm-Hand Length
M3=Sitting Height M9=Bideltoid Diameter
M4=Eye Height, Sitting M10=Hip Breadth
M5=Popliteal Height M11=Foot Length
M6=Buttock-Knee Length M12=Hand Length

Figure 3. 12 Anthropometric Measurements

Link No.	Link Name	Link No.	Link Name
1	Lumbar	11*	Radial Link
2	Thoracic	12*	Hand Link Clenched
3	Neck-Vertical	13*	Hand Link Finger
4	Neck-Horizontal		Grip
5	Lower Head	14*	Hand Link Extended
6	Eye Midpoint to Head	15*	Pelvic Link
7	Upper Head Link	16*	Femoral Link
8*	Interclavicular Link	17*	Tibial Link
9*	Clavicular Link	18*	Ankle Link
10*	Humeral Link	19*	Foot Link
*Has both	left and right links		

Figure 4. Link-man Numbering System

Because the CAR program had to be modified to be non-interactive, option two (edit) and option three (save) were not needed as the researcher could edit and save the operator file separately from the CAR program.

Option number four proved to be a useful function. This option allowed the data read from the input file to be printed and therefore checked for accuracy. This was actually a second check as earlier when the means for each anthropometric measurement were entered, an internal check was conducted to determine whether the entered mean was within plus or minus three standard deviations from the mean of the same anthropometric measurement from the 1964 survey of Naval Aviators. Therefore, between the two checks, both the reasonableness of the data and accuracy of the data could be checked.

Option five is the generate option of the generate sample function. This option makes use of a random number generation system to 'create' a sample of operators. The CAR system is set up to generate sample sizes up to 400. The generated sample is made up of 'link-men' (see Figure 5). It is these link-men that are used in the accommodation analysis. The numbering system of the links used in the formulas to determine link lengths of the generated sample are shown in Figure 4. The formulas to transform anthropometric measurements to link lengths are shown in Figure 6.

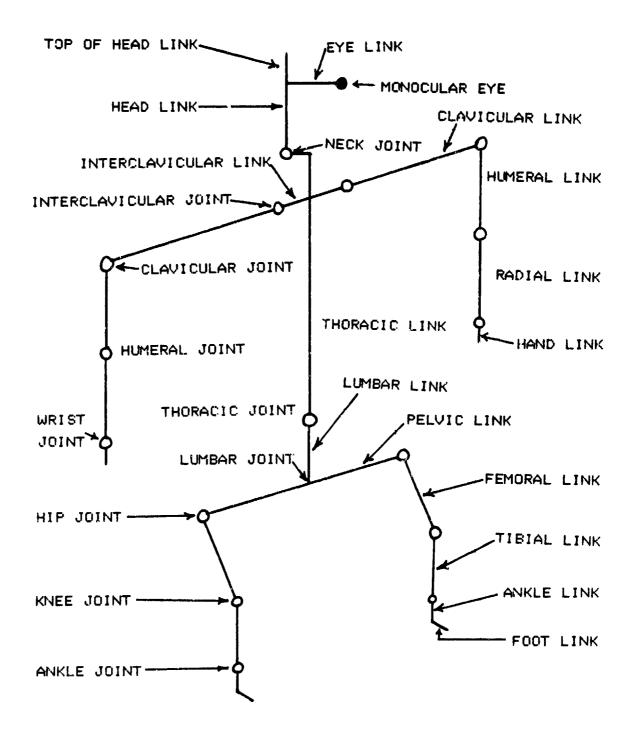


Figure 5. CAR Link-man Model

```
Defining Equation
Link
L1 = M2 + 1.0 -(L16 + L17 + L18)
      .4061 * M4 if M4 <= 25th percentile
     .3972 * M4 if 25th percentile < M4 < 75th percentile
      .3906 * M4 if M4 > 75th percentile
      L5 = .5 * (M1 - M2 - L2 - L7)
L4 =
     .5"
L6 = 4.5"
L7 = L3 - L4
L8 = 1.0"
      .3980 * M9 if M9 <= 25th percentile
      .3876 * M9 if 25th percentile < M9 <= 75th percentile
L9 =
      .3787 \times M9 if M9 > 75th percentile
      .8572 * M7 if M7 <= 25th percentile
      _8310 * M7 if 25th percentile < M7 <= 75th percentile
L10=
      .8131 * M7 if M7 > 75th percentile
      .5784 * M8 if M8 <= 25th percentile
      .5673 * M8 if 25th percentile < M8 <= 75th percentile
L11=
      .5577 * M8 if M8 > 75th percentile
L12= .5607 * M12
      .6248 * M12
L.13=
1.14=
      .9346 * M12
      .5087 * M10
L15=
      .7317 * M6 if M6 <= 25th percentile
      .7240 * M6 if 25th percentile < M6 <= 75th percentile
L16=
      .7173 * M6 if M6 > 75th percentile
L17=
      .9487 * M10
      4.4" + .15 (L11 - M11) / Std Dev of M11
      .6916 * M11 if M11 <= 25th percentile
L19= .6838 * M11 if 25th percentile < M11 <= 75th percentile
      .6770 * M11 if M11 > 75th percentile
```

Figure 6. Link Length Equations

#### The Crewstation Option

The logic flow of the crewstation option is shown in Figure 7. There are the four basic options within this function plus the option to return to the higher menu. Each of these options will now be discussed.

Option one, like that of the operator sample option, involves the input of data. This option is very flexible in that it gives the option of selecting one of several points from which to anchor the crewstation to be defined. Also, aside from describing the right hand coordinate system, the user is allowed to define the coordinate system to be used and the CAR program will in turn transform the crewstation to the internal coordinate system from which it accomplishes the accommodation analysis. A design eye point (DEP) must be specified in the crewstation definition, although this point does not necessarily have to be the anchor point. A line of sight (LOS) angle must also be specified along with data to fully describe the seat, its angles and adjustments (if any). The crewstation option is equipped to handle up to the definition of 50 controls with the following information (if applicable) gathered for each control defined: the control name, the control location (in x,y,z coordinates), the body part used to operate the control (either or both hands, either or both feet), the type of grip used to operate the control, whether the shoulder harness is locked while operating the control, whether it is a primary

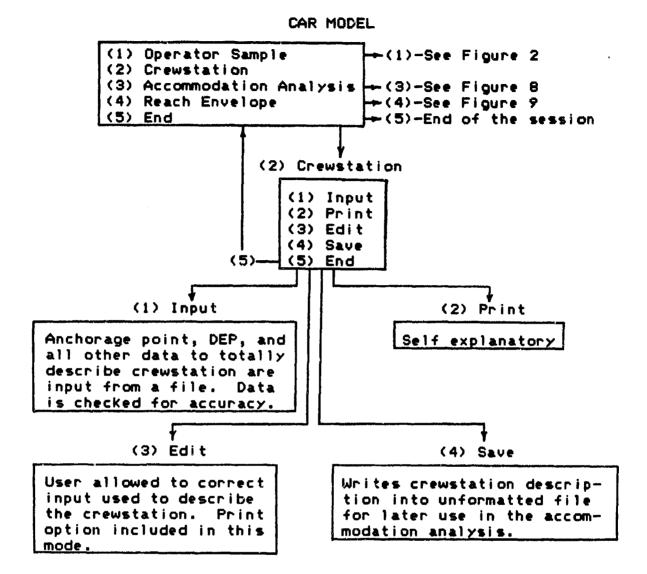


Figure 7. Crewstation Option

control, and the adjustable location of the control. There is also the option to evaluate head clearance by defining the minimum allowed head clearance, the helmet thickness and a point on the plane of the overhead obstruction.

The second option, print, is self explanatory.

However, as with the operator sample option, the print option allows the user to view his input to ensure the data were entered correctly.

The third option allows the user to edit the data used to define the crewstation. Included in this option is the ability of the user to print the data in the crewstation file. Again, because the CAR program had to be modified not to be interactive, this option was not useful to the researcher.

The fourth option was a most useful option. Because the crewstation could have up to 50 controls defined, the accommodation analysis routine 'looked' for 50 names of controls, 50 locations of controls, etc. Therefore, the save option of the crewstation function wrote to file the definitions of the crewstation using unformatted write statements. This filled in blanks for the names of the undefined controls and filled in zeroes for their locations. Thus, even though the researcher was required to create a file defining the crewstation to be read into the system during the input option, it was easier to let the CAR

crewstation save option save the crewstation definition and put in the required blanks and zeroes in the proper places.

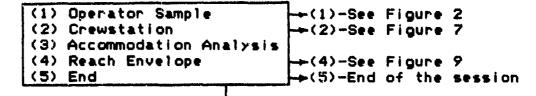
The Accommodation Analysis Option

The accommodation analysis option is, as the name suggests, the main function of the CAR program. The logic of this option is shown in Figure 8. This function first reads into memory the crewstation defined in the crewstation option. The user is then given the option to determine which controls will be used in the analysis. The user also is allowed to choose the sample size to be evaluated in the crewstation from the earlier sample that was generated and saved in the operator sample option. To allow for more realism, the user is also given the option to specify the type of clothing worn by the sample with unclad, summer flight clothing and winter flight clothing being the options. The user may also use the entire sample size specified or specify a certain percentile range such as 5th to the 95th percentile to be evaluated. Additionally, the user may further restrict the analysis to those operators that may adjust to the DEP or LOS. The accommodation analysis function then analyzes the data and prints out the results according to the information specified by the user.

The Reach Envelope Option

The reach envelope option is very similar to the accommodation analysis option. The logic for the envelope

#### CAR MODEL



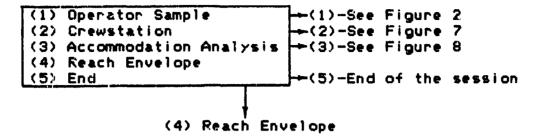
#### (3) Accommodation Analysis

- 1. Reads crewstation file (saved by Crewstation option) as input.
- 2. Allows user to determine which controls are to be used for the analysis.
- 3. Allows user to choose size of sample to be analyzed.
- 4. Allows user to choose between using the entire sample in the analysis or only those which fall into a specific percentile range.
- 5. Allows user to specify the operators in the sample to be unclad, wearing summer flight clothing or wearing winter flight clothing.
- 6. Allows user the option of analyzing the entire sample or only those that can adjust to the DEP.
- 7. Uses information above to evaluate the ability of each operator in the sample to position to the DEP and to reach the specified controls.
- 8. Generates a report that gives information concerning the ability of the elements in the sample to position to the DEP and make the required reaches.

Figure 8. Accommodation Analysis Option

option is shown in Figure 7. This option also starts by reading into memory the crewstation definition as saved by the crewstation option. The user again is allowed to choose the sample size and the mode of dress of the operators—unclad, summer flight clothing or winter flight clothing. The sample again may consist of the entire sample size or only those able to adjust to the DEP or LOS. The user is also allowed to specify the reach envelope that is desired. Some of the options include the envelope created by all reaches with the shoulder harness locked, that created with the shoulder harness unlocked, that created by left side reaches, that created by right side reaches and that created by reaches by type of grip.

### CAR MODEL



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- 1. Reads crewstation file (saved by Crewstation option) as input.
- 2. Allows user to choose size of sample to be analyzed.
- 3. Allows user to specify the operators in the sample to be unclad, wearing summer flight clothing or wearing winter flight clothing.
- 4. Allows user the option of analyzing the entire sample or only those that can adjust to the DEP.
- 5. Allows user to specify the reach envelope desired:
  - a) with shoulder harness locked
  - b) with shoulder harness unlocked
  - c) left side reaches
  - d) right side reaches
  - e) reaches restricted to the type of grip (clenched, fingertip, or extended finger).

Figure 9. Reach Envelope

## 111. CREWSTATION DEFINITION AND OPERATOR SAMPLE GENERATION

### Defining the Crewstation

The CARII software is very flexible in that it allows the user to input the controls and other features that define the crewstation according to any coordinate system. The program then defines the crewstation according to an internal system, makes the analysis, and converts back to the user's system for output. Regardless of whether the crewstation to be defined has a DEP, however, the user is required to input the coordinates of a DEP. Additionally, the user is required to enter a line of sight (LOS) angle from the DEP to a device such as a Heads Up Display (HUD). The CAR program allows for a possible seven anchorage points (the origin of the coordinate system) as follows: 1) DEP, 2) seat, 3) foot while seated, 4) foot while standing, 5) hip, 6) shoulder while seated, and 7) shoulder while standing. It is from this chosen anchorage point that all other points in the crewstation are defined. Additionally, the following seat information is required: seat back angle, seat pan angle, and (if the seat is adjustable) the coordinates of the seat in the down back position, the down front position, the up front position and the up back position. If the seat is not adjustable, the coordinates of the

seat reference point (SRP) are assigned to the down back position.

Each of the controls to be defined (up to a maximum of 50) are also input in several steps. The name of the control, its location (with respect to the previously defined anchor point), the body part that uses the control (left hand, right hand, both hands, left foot, right foot, both feet), the grip used (clenched, fingertip, extended finger-for hand controls only), the shoulder harness condition (locked or unlocked), the importance of the control (primary or not), and the adjustable location of the control are input for each control.

A diagram of the OH-58A cockpit taken from the Operator's Manual (and modified by the researcher) is shown in Figure 10. Figure 11 depicts the overhead console. For the purposes of this study, the researcher chose to define the OH-58A cockpit as three different crewstations. The first defines the OH-58A cockpit as seen from the pilot's station, assumes the pilot is flying the aircraft, and uses the pilot's SRP as the anchor point for the crewstation. By saying that it is assumed that the pilot is flying the aircraft it is meant that the pilot will keep the right hand on the cyclic and reach all other controls with the left hand or the feet as appropriate. The only exception to that was the reach for the emergency door release. Due to the location

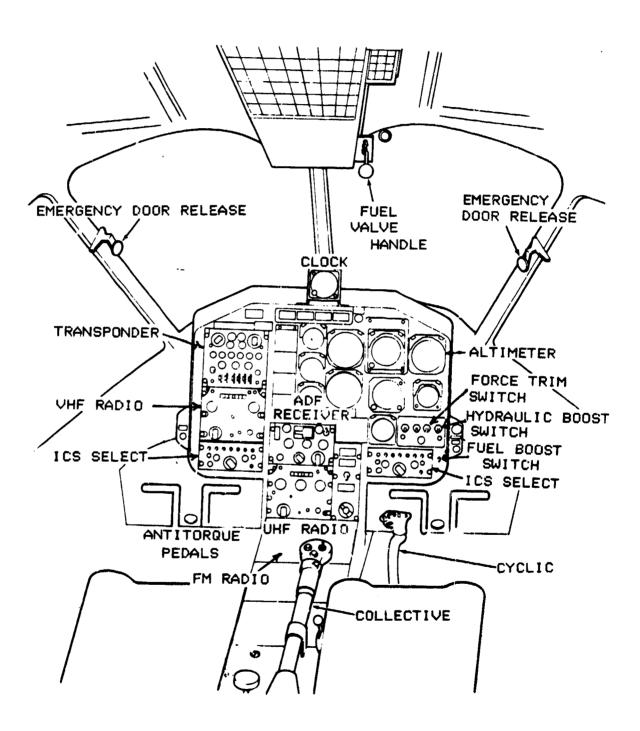


Figure 10. OH-58A Cockpit

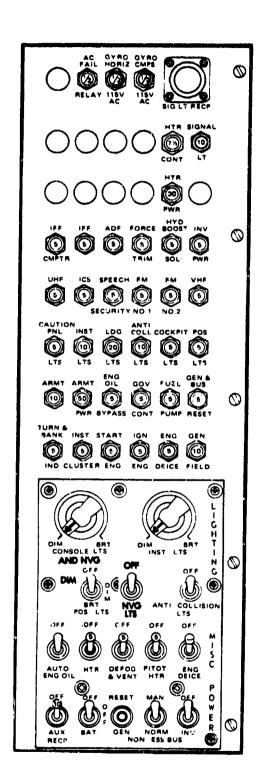


Figure 11. OH-58A Cockpit Overhead Console

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of that handle, it is extremely doubtful that the reach would be made with the left hand.

The researcher chose a total of 24 controls to examine in the analysis of the OH-58A cockpit. Several of the controls were difficult to define because the user is only given two locations with which to define each control and several controls could be routinely expected to be moved in many directions. The controls the researcher chose to define and the reason behind the location(s) chosen follows.

The first control defined was the cyclic. The two locations chosen to define the cyclic were a central location where the cyclic could be expected to be positioned for straight and level flight and a far forward position to determine if the operators could move the control out away from the body.

The definition of the collective had to be altered because the CARII program would not accept the locations of the control as input by the researcher originally. As a check against what the program calls 'unreasonable control movement', the adjustable location of the control is checked against the main location of the control according to the following:

$$2$$
 2 2 .5 [(X1-X2) + (Y1-Y2) + (Z1-Z2)] <=10

When defining the position of the hand on the collective in the full down position (where it would be during ground operations and in emergency autorotation) and the full up position (where it may be at the end of an autorotational descent), the limit of 10 imposed by the program was exceeded. In order to make the program accept the definition of the collective, the Y and Z coordinates (X did not change) of the higher location were lowered by the same amount so that the control definition was accepted.

The left and right antitorque pedals were defined using the closest position of the pedals with the pedal adjustment in the closest and the farthest pedal adjustment with the pedal adjustment in the farthest position. The reason behind these decisions was to allow the short-legged operators a chance to be accommodated as well as the long-legged ones.

Several of the remaining controls, for example the fuel boost switch and the hydraulic boost switch, were defined by their exact locations. The remaining controls, for example the radios, were defined using their midpoints. The reason for this decision was that the radios had several control knobs, and several other less used switches were within very close proximity to each other. For the computer printout defining the OH-58A cockpit from the pilot's perspective, see Appendix B.

The second definition of the OH-58A cockpit used the copilot's (left seat) perspective. The anchor point used was the SRP of the copilot's seat. In this case, as with

the pilot, it is assumed that the copilot is flying the aircraft and that the right hand will be on the cyclic and therefore all reaches will be made with the left hand. It would be expected that this decision will probably lead to very low percentages of those able to make reaches because nearly all of the reaches would be across the body. ever, it is highly unlikely that one would be flying in the left seat without a rated pilot (or student pilot) in the right seat to make any necessary reaches that would be difficult for the copilot to make. Additionally, some copilots are known to switch the control of the cyclic to the left hand while making adjustments of another control with the right hand. The third definition of the OH-58A crewstation helps compensate for the unreality of this definition. The computer printout for the definition of the OH-58A cockpit from the perspective of the flying copilot is shown in Appendix C.

。如果是我们的是一种,他们也是不是的,他们也是不是一种,他们们的是一种,他们们的是一种,他们们的是一种,他们们们的一种,也可以是有一种,也可以是这种的,我们们们的

The third definition of the OH-58A cockpit is that from the point of view of an aerial observer. The aerial observer would sit in the copilot's (left) seat, and therefore the crewstation is defined exactly as it is for the copilot with the exception that the reaches are attempted with the closest hand or foot. The computer printout for the definition of the OH-58A cockpit from the perspective of the aerial observer is shown in Appendix D.

## Generating the Operator Sample

In order to generate an operator sample, the CARII program requires that the means and standard deviations of the 12 previously mentioned anthropometric measurements are entered into memory from file or interactively. Additionally, the correlation matrix relating the measurements must be input. Through the use of these data and the use of a random number generation system, a sample of link-men will be generated with the sample size being user directed up to 400. Because the crewstation defined was that of an Army helicopter cockpit, the researcher chose the means and standard deviations of the 12 required measurements from the 1970 anthropometric survey done on Army aviators. 'The correlation matrix data used was that of the 1964 survey of Navy aviators. The researcher chose to generate a sample size of 200. The computer printout of the operator data used to generate the sample used in the analysis portion is shown in Appendix E.

## IV. RESULTS

## The Operator Sample

The researcher chose to generate a sample size of 200. From the 200 generated in the sample, the first 50 link-men were chosen to be used in the accommodation analysis. Additionally, only those link-men in the range between the 5th and 95th percentile of each of the 12 anthropometric measurements were evaluated in the crewstation. That reduced the sample size to 29. The 21 link-men that failed to meet the 5th through 95th percentile requirements and the measures that they failed to meet are shown in Table 1. To ensure equal comparisons, the same operator sample was used in the analysis of all three of the defined versions of the OH-58A cockpit.

### The Crewstations Analyses

All 24 controls defined in each of the crewstations were evaluated for reach in the analyses. The summer clothing option was chosen for all analyses as a compromise between the unclad option and the winter clothing option. The vision accommodation output was ignored as the OH-58A was without a DEP and therefore an estimation of the DEP was input from the specifications of the OH-58D model. The LOS data were also ignored as the input of the -13 degrees was an estimation on the part of the researcher. For the control

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Table 1
Sample Link-men
Outside the 5th and 95th Percentiles

Measurement	Number of	Link-men
Number		Identification
1	7	12
		14
		22
		24 28
		43
		44
2	4	1
		7
		13 40
3	0	0
4	1	15
5	4	5
		34
		<b>36</b>
		46
6 	0	0
7	2	6
	ن که در اس به	37
8	1	11
9	0	0
10	1	30
11	1	39
12	0	0

summary, all reaches are checked for Zone 3 accommodation, Zone 3 being for the shoulder harness in the unlocked position. The percentage of the 29 link-men able to make the required reaches to the 24 controls are shown in Tables 2 and 3 for the pilot's crewstation. The same data for the copilot's crewstation are shown in Tables 4 and 5. The data for the observer are shown in Tables 6 and 7. Tables 8 and 9 give a comparison between the three definitions of the same crewstation. The computer printout for the pilot's crewstation analysis is shown in Appendix F. Appendix G contains the analysis of the copilot's crewstation while the observer's printout is shown in Appendix H.

Table 2
Link-men Able to Make Required Reaches,
Controls 1 Through 12
OH-58A Cockpit (Pilot)

Control Number	Control Name	
i	Cyclic	100
2	Collective	100
3	Right Antitorque Pedal	34
4	Left Antitorque Pedal	100
5	Fuel Boost Switch	100
6	Pilot ICS Select	89
7	Force Trim Switch	100
8	Hydraulic Boost Switch	100
9	Altimeter Set Knob	100
10	UHF Radio	75
11	VHF Radio	100
12	Transponder	100

Table 3

Link-men Able to Make Required Reaches,

Controls 13 Through 24

OH-58A Cockpit (Pilot)

	هد شهر شه هيد هي هيد شه هذا الله الله الله شه هيد شه هيد هيد هي هيد هيد هيد هيد هيد هيد ميد سيد وي	
Number	Control Name P	ercentage of Link—men
13	Clock	100
14	Inverter Switch	100
15	Battery/Generator Switches	100
16	Row 2 Switches, Overhead	89
17	Row 3 Switches, Overhead	65
18	Lighting Control Knobs	93
19	Hydraulic Boost Circuit Brea	ker 75
20	Fuel Valve Handle	100
21	Emergency Door Release	100
22	Caution Test/Reset Switch	100
23	FM Radio	100
24	ADF Receiver	96

Table 4

Link-men Able to Make Required Reaches,

Controls 1 Through 12

OH-58A Cockpit (Copilot)

Number	Control Name	Link-men
1	Cyclic	100
2	Collective	100
3	Right Antitorque Pedal	34
4	Left Antitorque Pedal	100
Marie Naux	Fuel Boost Switch	0
6	Copilot ICS Select	75
7	Force Trim Switch	0
8	Hydraulic Boost Switch	0
9	Altimeter Set Knob	0
10	UHF Radio	0
11	VHF Radio	100
12	Transponder	100

Table 5

Link-men Able to Make Required Reaches,

Controls 13 Through 24

OH-58A Cockpit (Copilot)

Number	Control Name P	ercentage of Link-men
13	Clock	100
14	Inverter Switch	100
15	Battery/Generator Switches	100
16	Row 2 Switches, Overhead	100
17	Row 3 Switches, Overhead	100
18	Lighting Control Knobs	96
19	Hydraulic Boost Circuit Brea	Ker O
20	Fuel Valve Handle	34
21	Emergency Door Release	100
22	Caution Test/Reset Switch	55
23	FM Radio	34
24	ADF Receiver	0

Table 6

Link-men Able to Make Required Reaches,

Controls 1 Through 12

OH-58A Cockpit (Observer)

Number	Control Name	Link-men	
1	Cyclic	100	
2	Collective	100	
3	Right Antitorque Pedal	34	
4	Left Antitorque Pedal	100	
5	Fuel Boost Switch	100	
6	Copilot ICS Select	75	
7	Force Trim Switch	100	
8	Hydraulic Boost Switch	100	
9	Altimeter Set Knob	100	
10	UHF Radio	68	
11	VHF Radio	100	
12	Transponder	96	

Table 7

Link-men Able to Make Required Reaches,

Controls 13 Through 24

OH-58A Cockpit (Observer)

Control Number		Percentage of Link-men
13	Clock	100
14	Inverter Switch	100
15	Battery/Generator Switches	96
16	Row 2 Switches, Overhead	55
17	Row 3 Switches, Overhead	20
18	Lighting Control Knobs	58
19	Hydraulic Boost Circuit Brea	iker 34
20	Fuel Valve Handle	100
21	Emergency Door Release	100
22	Caution Test/Reset Switch	100
23	FM Radio	100
24	ANE Pagainan	20

Table 8

Link-men Able to Make Required Reaches,

Comparison by Cockpit,

Controls 1 Through 12

Control	Control Name	Pilot	Copilot	Observer
1	Cyclic	100	100	100
2	Collective	100	100	100
3	Right Antitorque Pedal	34	34	34
4	Left Antitorque Pedal	100	100	100
5	Fuel Boost Switch	100	100	0
6*	ICS Select	89	75	75
7	Force Trim Switch	100	0	100
8	Hydraulic Boost Switch	100	0	100
9	Altimeter Set Knob	100	0	100
10	UHF Radio	75	0	68
11	VHF Radio	100	100	100
12	Transponder	100	100	96

\*Pilot to pilot's ICS control; copilot & observer to copilot's ICS control.

Table 9
Link-men Able to Make Required Reaches,
Comparison by Cockpit,
Controls 13 Through 24

Control	Control Name	Pilot	Copilot	Observer
art day am lam age age age age age				
13	Clock	100	100	100
14	Inverter Switch	100	100	100
15	Battery/Generator	100	100	96
16	Row 2 Switches, Overhead	<del>i</del> 89	100	55
17	Row 3 Switches, Overhead	i 65	100	20
18	Lighting Control Knobs	93	96	58
19	Hydraulic Boost C.B.	75	0	34
20	Fuel Valve Handle	100	34	100
21*	Emergency Door Release	100	100	100
22	Caution Test/Reset	100	55	100
23	FM Radio	100	34	100
24	ADF Receiver	96	0	89

\*Pilot to the right door; copilot & observer to the left door.

## V. DISCUSSION

## The Single Person Crewstation

The results of the accommodation analyses, which looked at the OH-58A cockpit from three different single operator perspectives, appeared to be fairly accurate with a few exceptions. The data as presented in a diagram from Bell Helicopter showed that the antitorque pedals were not equally spaced on a center line through the seat reference point. Perhaps these data led to the discrepancy of the percentage accommodated by each of the pedal locations. A probable contributing factor to the zero accommodation to the pedals in the adjustable location was that the researcher chose the furthest position of the pedal travel with the furthest adjustment of the pedals. Regardless of the position of the adjustment, full pedal travel of either pedal is very rarely required.

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# Extending the Results to the Shared Crewstation

To demonstrate the use of CARII with a shared crewstation, the researcher performed an accommodation analysis with one of the 'controls', the UHF Radio, repositioned to two alternate locations without examining the design feasibility of making such moves. The researcher defined the main location to be exactly one inch higher than the actual

Table 10
Link-men Able to Make Required Reaches,
Comparison by Cockpit,
Control Number 10

Control Name	New Location	Actual	New
UHF Radio (Pilot)	1" Higher		
UHF Radio (Pilot)			1° qabi. spam qapi qada diga adda d
	1° Right	75	93
UHF Radio (Copilot)	1" Higher	68	0
UHF Radio (Copilot)			
	1" Right	<b>68</b>	0
UHF Radio (Observer)	1" Higher		89
UHF Radio (Observer)		Min apir gan dap amb gan man amb gan gan ban dag g	
	1" Right	0	89

the coordinates of a move one inch higher (as above) and one inch to the right of the actual location. The results of the new analyses compared to the original analyses are shown in Table 10. The computer printouts are shown in Appendix I.

In looking at Table 10, one can easily see that the designer can utilize a evaluation tool such as the CARII program and make an evaluation of the design by determining how changing the positions of controls affects each of the operators in the shared crewstation. In the case of repositioning the UHF radio to either of the two 'proposed' locations, the percentage of the pilots able to reach the radio increased dramatically with even a greater increase in the percentage of observers able to make the reach. Therefore, if the designer is given a priority of controls by operator station, a design which is greater able to meet the user's needs can be attained. Additionally, the designer could ascertain if changing the type of reach (extended finger versus fingertip, for example) would improve the percentage accommodated and therefore specify a control requiring that movement for operation.

The criterion for duplicate controls could also be gotten from the analysis of the UHF Radio. If, for example, the requirement existed from the user that 85% of users from either seat should be able to use the UHF Radio, the original location would not meet the requirement for either crew

position. However, the new design location, if feasible, would demonstrate that one UHF Radio, if placed in that position, would more than meet the design requirements.

## VI. CONCLUSIONS and RECOMMENDATIONS

### Conclusions

The Crewstation Assessment of Reach (CARII) evaluation program was used to define a shared crewstation, that of an OH-58A cockpit. Additionally, the CARII program was used to generate the operator sample against which the design of the the crewstation was evaluated. The printouts gave (according to the program) the percentage of operators able to make the required reaches in the crewstations.

The analyses given as output by the CARII program were not validated by the researcher. However, the researcher did show that use of the results of the analyses could be used to better the design of the workstation by examining the reaches of operators in both workstations simultaneously. As shown in the comparison of alternate locations for the UHF Radio, the researcher demonstrated that controls could be evaluated as they are placed in various positions in the crewstation with the final placement being obtained through the use of a priority system. Additionally, the CARII program could be used to determine whether to have duplicate controls by examining the analysis data, as done by the researcher, and then establishing minimum criteria for reaches from each crew position.

## Recommendations

As a result of this research, the following recommendations are made:

- 1. The CARII program should be validated for use in a shared crewstation such as a helicopter cockpit.
- 2. The restriction of the allowable movement of a control from the main control location to its adjustable location should be examined for validity.
- 3. With a specialized crewstation like that of a helicopter, perhaps the need to include up to four anchor points (seat, left foot, right foot, and right hand for example) should be examined. When a pilot is at the flight controls, each of these extremities is restricted to a specific area.
- 4. A priority system for the placement of controls in the cockpit must be established for use in the design stage.
- 5. Minimum criteria for the percentage accommodated by each control location, must be established for use in the design stage so the requirement for duplicate controls can be established.

等是是是是是一种,是是是是是这种,是是是是是是一种,他们也是是是一种,他们也是是是是是是是是是是一种的,他们也是是一种的。

 Link equations should continue to be refined to include the female population.

### BIBLIOGRAPHY

- Advisory Group for Aeronautical Research and Development, North Atlantic Treaty Organization, <u>Anthropometry and</u> <u>Human Engineering</u>, London: Butterworths Scientific Publications, 1955.
- Babbs, F.W., "A Design Layout Method for Relating Seating to the Occupant and Vehicle," <u>Ergonomics</u>, 22(2), 227-237 (1979).
- 3. Bittner, A.C., Jr., "Computerized Accommodated Percentage Evaluation (CAPE) Model for Cockpit Analysis and Other Exclusion Studies," (TP-75-49/TIP-03) Point Mugu, California: Pacific Missile Test Center (1975).
- 4. Bittner, A.C., Jr., "Toward a Computerized Accommodation Percentage Evaluation (CAPE) Model for Automotive Interiors," (SAE Report 780281) Warrendale, Pennsylvania: Society of Automotive Engineers (1978).
- 5. Bittner, A.C., Jr., Morrissey, S.J., and Moroney, W.F., "Demonstration of an Approach to Evaluate Cockpit/Aircrew Anthropometric Compatibility: Advanced Harrier (AV-16A) Analysis," (TP 75-31) Point Mugu, California: Pacific Missile Test Center (1975).
- Bonney, M.C. and Williams, R.W., "CAPABLE. A Computer Program to Layout Controls and Panels," Ergonomics, 20(3), 297-316 (1977).
- 7. Bullock, Margaret I. "The Determination of Functional Arm Reach Boundaries for Operation of Manual Controls," Ergonomics, 17(3), 375-388 (1974).

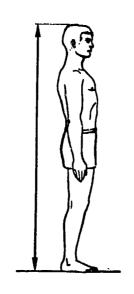
- 8. Churchill, Edmund, McConville, John T., Laubach, Lloyd L., and White, Robert M. "Anthropometry of U.S. Army Aviators-1970," (Technical Report 72-52-CE) Natick, Massachusetts: United States Army Natick Laboratories (1971).
- 9. Fitts, Paul E. and Jones, R.E., "Analysis of Factors Contributing to 460 "Pilot-Error" Experiences in Operating Aircraft Controls," in <u>Selected Papers on Human</u> <u>Factors in the Design and Use of Control Systems</u>, 332-58. Edited by H. Wallace Sinaiko, New York: Dover Publications, Inc., 1961.

- 10. Harris, Regina M., Bennett, Jay, and Dow, LuAnne.
  "CAR-II-A Revised Model for Crewstation Assessment of
  Reach," (Technical Report 1400.06B) Willow Grove, Pennsylvania: Analytics, Inc. (1980).
- 11. Krause, H.E., and Kroemer, K.H.E. "COMBIMAN- A Computer Model of the Operator at his Workstation," in <u>Proceedings of the 17th Annual Meeting of the Human Factors Society</u>, October 16-18, 1973, 418-419. Edited by Maurice P. Rans, Jr. and Thomas B. Mælone. Santa Monica, California: Human Factors Society (1973).
- 12. Matheny, W.G. "Human Factors Considerations in Helicopter Design," (IAS Report No. 59-83) New York: Institute of the Aeronautical Sciences (1959).
- 13. Murphy, George L. "Workplace Layout and Equipment Design," in <u>Human Factors Methods for System Design</u>, 79-96. Edited by John D. Folley, Jr. Washington, D.C.: The American Institute for Research, 1960.
- 14. "New Cockpits Use Integrated Avionics," <u>Aviation Week</u> and Space Technology, 120(3), 148-56 (1984).
- 15. Operator's Manual Army Model OH-58A Helicopter, (TM55-1520-228-10) Washington, D.C.: Headquarters, Department of the Army, 1978.
- 16. Panero, Julius and Zelnik, Martin, <u>Human Dimension and Interior Space</u>, New York: Whitney Library of Design, 1979.
- 17. Perry, I.C., "Helicopter Aircrew Fatigue," (AGARD Advisory Report No.69) Neuilly Sur Seine, France: NATO Advisory Group for Aerospace Research and Development (1972).
- 18. Shapiro, Jacob, <u>Principles of Helicopter Engineering</u>, London: Temple Press Limited, 1955.
- 19. Technical Secretariate, International Air Transportation Association, "Helicopter Operation and Design Requirements," (Doc.Gen.1357) Montreal: International Air Transportation Association (1953).
- 20. Verdier, Paul A., Basic Human Factors for Engineers, New York: Exposition Press Inc., 1960.
- 21. Woodson, Wesley E. and Conover, Donald W., <u>Human Engineering Guide for Equipment Designers</u>, 2nd ed. Berkeley: The University of California Press, 1964.

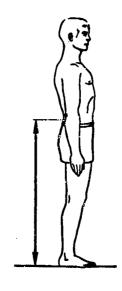
# APPENDICES

## APPENDIX A

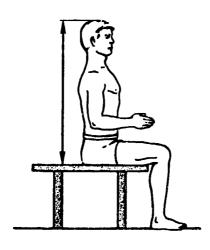
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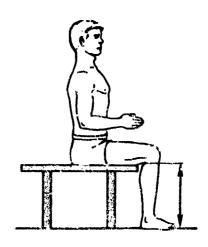
STATURE



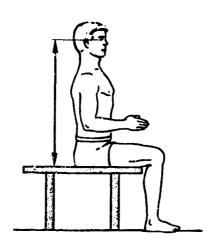
WAIST HEIGHT



SITTING HEIGHT



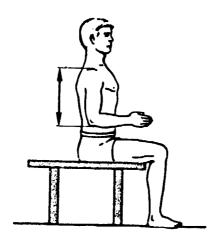
POPLITEAL HEIGHT



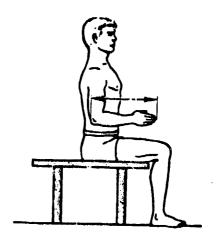


EYE HEIGHT, SITTING

BUTTOCK-KNEE LENGTH







FOREARM-HAND LENGTH



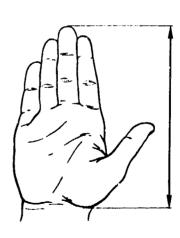


BIDELTOID DIAMETER

HIP BREADTH







HAND LENGTH

## AFPENDIX B

OH-58A COCKPIT-PILOT

act believessan telesions

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TREWSTATION ASSESSMENT OF BRACH (CAR) MODEL
TAR (1-DPER SAMPLE, 2-CPRWSTATION, J-ACCOR AWALYSIS, 4-REACH ENV, 5-END) -- 2
IDEN FUNCTIONS (1-INPUT, 2-PRINT, 3-EDIT, 4-SAVE, 5-END) --
IMPUT 40DE (1=INTERACTIVE; 2=FILE) --
CREW STATION DESCRIPTION -
           * 108-59A COCKPIT-PILOT*
ANCHORAGE (1-DEP, 2-SEAT, 3-FOOT SEATED, 4-FOOT STAND,
  5-HIP, 6-SHOULDER-SEATED, 7-SHOULDER-STAND) ?--
DESIGN BYE POINT:
DEP (X,Y,Z) -
     0.00
               3.90
                        33.03
DBP IN JP DIRECTION (X, Y, Z) -
               3.90
     0.00
                        43.03
DEP IN FORWARD DIRECTION (X,Y,Z) -
                        33.03
     0.00
             13.90
LINE OF SIGHT ANGLE -
     -13.00
SEAT BACK ANGLE -
       9.00
SEAT PAN ANGLE -
       9.00
HARNESS % -
SEAT REF POINT DOWN-BACK(X,Y,Z)-
0-00 0.00
      50.00
CONTROL NAME -
          CYCLIC
LOCATION (X, Y,Z) -
                    19.50
        0.00
                                  11.61
BODY PART (1-L3, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
GRIP (1-CLENCHPD, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z)--
0.00 25.55
                                  10.76
        6.11
                     10.00
CONTROL NAME -
         COLLECTIVE
LOCATION (X,Y,Z) -
                 17.30
                                  0.00
      -10.80
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-8F) --
JPIP(1-CLENCHED, 2-PINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCT, 2-UNLOCK) --
```

```
PRTHART (1-YES, 2-NO) --
 £DJUSTABLE LOCATION (x, Y, Z) -- -10.80 12.47
                                     E. 75
          9.99
                      10.00
 CONTROL WARE -
           TRY ANTITOROUS PFD
 LOCATION (X,Y,Z) -
          4.00
                      32.65
                                   -6.26
 BODY PART (1-LH, 2-RH, 3-DH, 4-LF, 5-RY, 6-BF) --
 PRIMARY (1-YES, 2-RO) --
ADJUSTABLE LOCATION (X, Y, Z) -- 4.00 42.15
                                    -7.76
          9.62
                      10.00
CONTROL NAME -
LOCATION (X,Y,Z) - 32.65
          'LFT ANTITORQUE PFD
                                   -6.26
BODY PART (1-th, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
PRIMART (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) -- -5.50 42.15
                                   -7.76
         9.62
                      10.00
- SHAW JCSTROD
          'FUEL BOOST SW
- (S,Y,X) WCITAGOL
                  30.00
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-EF, 6-FF) --
GRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-40) --
ADJUSTABLE LOCATION (X,Y,Z) --
        -0.88
                     30.00
                                    7.13
        0.00
                      10.00
CONTROL NAME -
          'PILOT ICS SELECT
LOCATION (X,Y,Z) -
                    30.00
        -4.13
BODY PART (1-LH, 2-RH, 3-BH, 4-LP, 5-RP, 6-BF) --
SRIP (1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLUCK) --
PRI HARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) --
       -4.13
                     30.00
                                    6.63
        0.00
                     10.00
CONTROL NAME - PORCE TRIM SW
LOCATION (X,Y,Z) -
```

```
30,00
BODY PART (1-LH, 2-RR, 3-BH, 4-LF, 5-RF, 6-BF) --
JRIP (1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PPI MARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) -- -1.88 30.00
        -1.88
                                  10.13
        0.00
                     10.00
CONTROL NAME -
         *HYD BOOST SE
LOCATION (X,Y,Z) -
       -0.88
                    30.00
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
GRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
2RIMARY (1-YES, 2-NO) --
10, 13
        0.00
                    10.00
CONTROL NAME -
        'ALT SET KNOB
LOCATION (X,Y,Z) -
                    30.00
       -3.13
BODY PART (1-LH, 2-RH, 3-BH, 4-LP, 5-RF, 6-BF) --
JRIP(1-CLENCRED, 2-FINGER TIP, 3-EXTENDED) --
RARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-KO) --
ADJUSTABLE LOCATION (X,Y,7) --
                    30.00
                                 15.13
       -3.13
        0.00
                    10.00
CONTROL NAME -
        THE PADIO
LOCATION (X,Y,Z) -
                   30.00
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
GRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARRESS (1-LOCK, 2-UMLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (Y,Y,Z) --
      -13.32
                    30.00
                                  4.63
        0.00
                    10.00
CONTROL NAME -
        VHF PADTO
LOCATION (X,Y,Z) -
```

是是这种,我们是这种,我们是这种,我们是这种,我们是这种,他们也是一个人的,我们也可以是一个人的,我们也可以是一个人的,我们也可以是一个人的。""我们是这种人的

```
30.00
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
JRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIHARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z)--
-19.88 30.00
                                   11.13
         0.00
                     10.00
CONTROL MAME -
          TRANSPONDER
LOCATION (X,Y,Z) -
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
SRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,7) --
                     30.00
       -19.88
                                  16.13
        0.00
                     10.00
CONTROL NAME -
         *CLOCK
LOCATION (X,Y,Z) -
        -8.13
                     30.00
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
GRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HAR NESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z)---
-8.13 30.00
0.00 10.00
                                  22.13
CONTROL NAME -
         'INVERTER SW
LOCATION (X,Y,Z) -
                     11.50
                                  36.00
      -10.25
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
SRIP(1-CLENCHED, 2-FINGER TIP, 3-FXTENDED) --
HAR NESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
36.00
        0.00
                     10.00
CONTROL NAME -
         FRAT/GRN SWS
LOCATION (X,Y,Z) -
```

```
11.50
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-RF) --
GRIP (1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARMESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,7)--
-12.13 11.50
                                    36.00
         0.00
                      10.00
CONTROL WARE -
         POW 2 SW, OVRHD
LOCATION (X,Y,Z) -- -12.13
                       9.17
BODY PART (1-LR, 2-RR, 3-BR, 4-LP, 5-RF, 6-BF) --
GRIP (1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIHARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z)--
-12.13 9.13
       -12.13
         0.00
                      10.00
CONTRGL NAME -
         ROW 3 SW, OVEHD
LOCATION (X,Y,Z) -
                       7.75
                                    36.00
       -12.13
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-RF) --
JRIP(1-CL ENCHED, 2-FINGER TXP, 3-EXTENDED) --
BARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) -- -12.13 - 9.13
       -12.13
                                    36.00
                      10.00
         1.38
CONTROL NAME -
         'IGT CONT KNOBS
LOCATION (X,Y,Z) - -12.13
                       5.50
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
3RIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z)--
-12.13 5.50
       -12.13
                                    36.00
         0.00
                      10.00
CONTROL NAME -
         'HYD BOOST CIP BK
LOCATION (X,Y,Z) -
```

LANGUE LANGUE LANGUE LANGUE LANGUE LA SERVICIO LA SERV

いいから 日本日本のはのはいからなる 一種ののはのないないので

```
-12.13
                     -2.38
                                   36.00
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
SRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HAR NESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NC) --
ADJUSTABLE LOCATION (Y,Y,7)---
-12.13 -2.38
                                   36.00
         0.00
                      10.00
CONTROL NAME -
         PUEL VALVE HANDLE
LOCATION (X, Y, Z) -
                     14.00
        -8.00
                                   36.00
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
3RIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) --
        -8.00
                     14.00
                                   36.00
         0.00
                      10.00
CONTROL NAME -
         *ERER DOOR PEL
LOCATION (X,Y,Z) -
         9.00
                     18.25
                                   29.50
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
SRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRTHARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z)--
9.00 18.25
                                   29.50
         0.00
                     10.00
CONTROL NAME -
         'CAU TEST/RESET
LOCATION (X,Y,Z) -
                     18.05
       -9.55
                                  -2.50
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-FF, 6-BF) --
GRIP (1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) --
                     18.05
       -9.55
                                  -2.50
         0.00
                     10.00
CONTROL WARR -
         *FH PADIO
LOCATION (X,Y,Z) -
```

```
17.55
       -13.55
BODY PART (1-LII, 3-MM, 3-RH, 4-LY, 5-RF, 6-BF) --
3RIP (1-CLENCHED, 2-FINGER TIP, 3-FXTEHDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-185, 2-NO) --
ADJUSTABLE LOCATION (X, Y, Z) -- -1 3.55 17.55
         0.00
                     10.00
CONTROL NAME
         ADP RECEIVER
LOCATION (X,Y,Z) - -13.55
                     22.05
BODY PART (1-LH, 2-RH, 3-BH, 4-LP, 5-RF, 6-BF) --
GRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) --
                     22.05
      -13,55
                                  -2.50
        0.00
                     10.00
CONTROL NAME -
HIN HEAD CLEAPANCE -
       0.00
BELNET PHICKNESS -
       0.00
HEAD CLEARANCE COORDINATES (X,Y,Z) -
                                   0.00
                      0.00
CREW PUNCTIONS (1-INPUT, 2-PRINT, 3-FDIT, 4-SAVE, 5-END) --
PRINT HODE (1-DESC, 2-ANCHOR, 3-DFP, 4-SEAT, 5-CONTROL, 6-HEAD, 7-HAC, 8-ALL, 9-END) --
CREW STATION DESCRIPTION -
                                         OH-58% COCKPIT-PTLOT'
ANCHORAGE -
                                         SEAT
DESIGN EYE POINT:
                                          0.00
                                                    3.90
                                                             33.03
DEP (X,Y,Z) -
                                                    3.90
DEP IN UP DIRECTION (X,Y,Z) -
                                                             43.03
                                          0.00
DEP IN PORWARD DIRECTION (X,Y,Z)
                                          0.00
                                                   13,90
                                                             33.03
LINE OF SIGHT ANGLE -
                                        -13.00
SEAT DATA:
SEAT BACK ANGLE -
                                          9.00
SEAT PAN ANGLE -
                                          8.00
                                         50.00
SEAT REP POINT DOWN-BACK(X,Y,%) -
                                          0.00
                                                    0.00
                                                              0.00
SEAT UP-BACK(X,Y,Z) -
                                          0.00
                                                    0.00
                                                              0.00
                                                              0.00
SEAT DOWN-FORWARD (X,Y,Z) -
                                          0.00
                                                    0.00
CONTROLS:
```

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		PODY	HAPN		PRIS	toc	ATION	
CH	CONTROL NAME CYCLIC COLLECTIVE RT ANTITOPQUE PED LFT ANTITOPQUE PED	PART	LOCK	GRIP	NON-P	X	Y	Z
**		~					40 50	
•	CICLL	πn	UNLK	CLER	F. 11 12	0.00	25.55	10.76
2	COLLECTIVE	T.H	II WE. R	CLEN	DRTH	-10.80	17.30	0.00
•	COMBINETITY		0 11 211		- " - "	-10.80	12.47	8.75
3	RT ANTITOROUR PED	RF			PRIS	4.00	32.65	-6.26
	· <del>-</del>					4.00	42.15	-7.76
4	LFT ANTITOPQUE PED	LF			PRIM	-5.50	32.65	-6.26
						-5.50	42.15	-7.76
5	PUEL BOOST ST PILOT ICS SELECT	LH	UNLK	EXTP	A-MC#	-0.88	30.00	7.13
			****		<b>**</b>	-0.88	30.00	7.13
b	PILOT ICS SELECT	LH	OMPK	FTIP	4-ACM	-4. 13	30.00	6.63
7	**************************************	7 11	CHER		M 2 N D	-4. 13	30.00	10.03
•	PORCE TRIM SW	Ln	0 41.7	DATE	474-5	- 1. 88	30.00	10.13
8	HYD BOOST SW	T.H	II NT. K	FTTP	MOH-P	-0.88	30.00	10.13
_						-0.88	30.00	10.13
9	ALT SET KNOB	LH	UNLK	PTIP	M - M C M	-3.13	30.00	15.13
						-3.13	30.00	15.13
10	HYD BOOST SW ALT SET KNOB UHP PADIO WHP RADIO	LH	UNLK	FTIP	4-4C4	-13.32	30.00	4.63
						-13.32	30.00	4.63
11	WHP RADIO	LH	UNLK	FTIP	N T T P	-19. HB	30.00	11.13
						- 1 74 00	30-40	11413
12	TRANSPONDER	M II	ONDU	FILE	474-5	-19.88	30.00	16 13
13	CLOCK	T. H	DRT.R	EXTE	HOM-P	-8. 13	30.00	22.13
	CEGCI	•	0 2			-8. 13 -8. 13	30.00	22.13
14	INVERTER SW	LH	UNLK	EXTF	A-4C#	-10.25	11.50	36.00
						-10.75	11 50	36.00
15	BAT/GEN SWS	LH	UNLK	RXTF	Y-NCM	-12.13	11.50	36.00
16	ROW 2 SW, DYRHD	LH	ONLK	EXTF	A-MCM	-12.13	9.13	36.00
4.7	2011 2 011 02012	•			<b>***</b>	-12.13	9.13	36.00
17	ROM 3 SM OAKHD	LH	UNLK	EXTP	M DM - P	-12.13	0.13	36.00
18	ROW 2 SW, DVRHD ROW 3 SW, DVRHD LGT CONT KNOBS	T.U	NWT.E	PTID	MAN-D	-12.13	5.50	36.00
.,	Ent Cont RECES		UNDI	1 4 4 5	11 O D - E	-12.13	5.50	36.00
19	HYD BOOST CIR BK	LH	UNLK	PTIP	NON-P	-12. 13	-2.38	36.00
						-17 17	-2 38	36 00
20	FUEL VALVE HANDLE	LH	UNLK	CLEN	MON-P	-8.00	14.00	36.00
						-8.00	14.30	36.00
21	EMER DOOR REL	RH	UNLK	CLEN	H-HCH	9.00	18.25	29.50
						9.00	18.25	29.50
22	FUEL VALVE HANDLE EMER DOOR REL CAU TEST/RESET	LII	UNLK	EXTE	<b>Ч-ИСИ</b>	-9, 55	18.35	-2.50
22	PH PADIO	T U	N W 7 =	<b>27</b> T D	#3#-P	-13.55	10.33	-2.50
23	LU PROTO	ыn	OUPV	LIIP	4 - 41'' u	-13.55	17.55	-2.50
24	ADP RECEIVER	LH	UNLK	FTIP	NON-P	-13.55	22.05	-2.50
						-13.55	22.05	-2.50

HEAD CLEARANCE:
HIN HEAD CLFARANCE - 0.00
HPLMET THICKNESS - 0.00
HEAD CLEARANCE COORDINATES(X,Y,Z) - 0.00 0.00

CPBW FUNCTIONS (1-IMPUT, 2-PRINT, 3-EDIT, 4-SAVE, 5-END) -
4
ENTER FILENAME FOR CREWSTATION ANALYSIS -'OHSOR'

++\*CREGSTATION DATA IS SAVED ON FILE:

CREW FUNCTIONS (1-IMPUT, 2-PRINT, 3-EDIT, 4-SAVE, 5-END) -
5
CAR (1-)PER SAMPLE, 2-CREWSTATION, 3-ACCOM ANALYSIS, 4-REACH ENV, 5-END) -5

IND OF CAR HODEL

# APPENDIX C

OH-58A COCKPIT-CCPILOT

```
TRENSTATION ASSESSMENT OF REACH (CAR) MODEL
CAR (1-OPER SAMPLE, 2-CREWSTATION, 3-ACCOM ANALYSIS, 4-REACH BW7, 5-EMD) -- 2
CREW FUNCTIONS (1-INPUT, 2-PRINT, 3-RDIF, 4-SAVE, 5-RND) ---
INPUT HODE (1=INTERACTIVE; 2=FILP) --
CREW STATION DESCRIPTION -
           **OH-58% COCKPIT-COPTLOT*
ANCHORAGE (1-DEP, 2-SEAT, 3-FOOT SEATED, 4-FOOT STAFD,
  5-HIP, 6-SHOULDER-SEATED, 7-SKOULDER-STAND) ?--
DESIGN EYE POINT:
DZP(X,Y,Z) -
               3.90
                       33.03
     0.30
DEP IN UP DIRECTION (X,Y,7) - 0.00 3.90 43.03
DEP IN FORWARD DIRECTION (X,Y,Z) -
                        33.03
     0.00
             13.90
LINE OF SIGHT ANGLE -
     -13.00
SEAT BACK ANGLE -
       9.00
SEAT PAN ANGLE -
       8.00
HARNESS 4 -
      50.00
SEAT REF POINT DOWN-BACK(X,Y,Z)-
CONTROL NAME -
          CYCLIC
LOCATION (X,Y,Z) -
        0.00
                  19.50
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
GRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z)--
        0.00
                    25.55
                                  10.76
                     10.00
        6.11
CONTROL NAME -
         COLLECTIVE
LOCATION (X,Y,Z) -
                    17.30
                                   0.00
      -10.BO
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
3RIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-1 OCK, 2-UNLOCK) --
```

```
PFIHARY (1-YES, 2-NO) --
 ADJUSTABLE LOCATION (X,Y,Z) --
                   12.47
       -10.80
                                    8.75
         9.99
                      10.00
 CONTROL NAME -
          TRY ANTITORQUE PED
 LOCATION (T, Y,Z) - 32.65
                                  -6.26
 BODY PART (1-LH .2-RK, 3-BH, 4-LP, 5-RP, 6-BF) --
 PRIMARY (1-YES, 2-NO) --
 ADJUSTABLE LOCATION (X,Y,Z)--
         4.00
                   42.15
                                   -7.76
         9.62
                     10.00
 CONTROL NAME -
          *LFT ANTITORQUE PED
LOCATION (X,Y,Z) -
-5.50 32.65
                                 -6.26
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
PRIMAPY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z)--
-5.50 42.15
                                  -7.76
         9.62
                     10.00
CONTROL WAME -
          PURL BOOST SW
LOCATION (X,Y,Z) -
19.48 30.00
                              7. 13
BODY PART (1-LH, 2-RH, 3-BH, 4-LP, 5-RP, 6-BF) --
GRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z)---
19.48 30.00
                                   7.13
         0.00
                     10.00
CONTROL NAME -
       *COPILOT ICS SELECT
LOCATION (X,Y,2) -
                    30.00
BODY PART (1-Lit, 2-RH, 3-BH, 4-LF, 5-RP, 6-BF) --
GRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) --
       -2.77
                  30.00
                                   6.63
        0.00
                    10.00
CONTROL BANK -
        *FORCE TRIM SW
LOCATION (X,Y,Z) -
```

```
18.48
                     30.00
                                   10,13
BODY PART (1-LH, 2-RH, 3-RH, 4-LT, 5-RF, 6-BF) --
SRIP (1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) -- 18.49 30.00
                                   10.13
         0.00
                     10.00
CONTROL WARE -
         HYD BOOST SW
LOCATION (X,Y,2) -
        19.48
                     30.00
                                   10.13
BUDY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RP, 6-BF) --
SRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HAPNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z)--
19.48 30.00
                                   10.13
         0.00
                     10.00
CONTROL NAME -
         VALT SET KNOB
LOCATION (X,Y,Z) - 17.23
                     30.00
                                   15.13
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
SRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PFI HARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,2) --
                     30.00
                                   15.13
        17.23
         0.00
                     10.00
CONTROL NAME -
         *UHF RADIO
LOCATION (X,Y,Z) -
         7.04
                     30.00
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-PF, 6-BF) --
grip(1-CLENCHFD, 2-Finger Tip, 3-Extended) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z)--
         7.04
                     30.00
         0.00
                     10.00
CONTROL NAME -
         *AHA BYDIO
LOCATION (X,Y,Z) -
```

```
30.00
                                   11, 13
BODY PART (1-LH, 2-RH, 3-BH, 4-LP, 5-RF, 6-BP) --
GRIP(1-CLENCHED, 2-PINGER TIP, 3-EXTENDED) --
HARRESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z)---
0.48 30.00
                                   11.13
         0.00
                     10.00
CONTROL NAME -
          TPANSPONDER
LOCATION (X,Y,Z) ...
                   .30.00
                                   16.13
         0.48
BODY PART (1-1H, 2-RH, 3-BH, 4-LP, 5-RP, 6-BF) --
GRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) -- 0.48 30.00
                                   16, 13
         0.00
                     10.00
CONTROL NAME -
         * CLOCK
 .23
                     30.00
                                   22.13
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-3F) --
GRIP(1-CLENCHED, 2-FINGER TIP, 3-FXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRI HARY (1-YES, 2-80) --
ADJUSTABLE LOCATION (X,Y,Z)--
12.23 30.00
                                   22, 13
         0.00
                     10.00
CONTROL NAME -
         'INVERTER SW
LOCATION (X,Y,Z) -
                     11.50
                                   36.00
        10.11
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
GRIP (1-CLENCHED, 2-PINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRI MARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) --
                     11.50
        10.11
                                   36.00
         0.00
                     10.00
CONTROL NAME -
         'BAT/GEN SWS
LOCATION (X,Y,Z) -
```

```
8,23
                      11.50
                                    36,00
BODY PART (1-LH, 2-RH, 3-BH, 4-LP, 5-RF, 6-RF) --
3RIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRI HARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,7) -- 8.23 11.50
         8.23
                                    36.00
         0.00
                      10.00
CONTROL WAME -
         *ROW 2 SW, OVRHD
LOCATION (X,Y,Z) - 8.23
                      9.13
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
GRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-MO) --
ADJUSTABLE LOCATION (X,Y,Z)~-
8.23 9.13
         8.23
                                   36.00
         0.00
                      10.00
CONTROL NAME -
         *ROW 3 SW.OVPHD
LOCATION (X,Y,Z) -
                      7.75
                                    36.00
         8.23
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-RF) --
GRIP (1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) -- 8.23 9.13
                                   36.00
         1.38
                      10.00
CONTROL NAME -
         LGT CONT KNOBS
LOCATION (X,Y,Z) -
                       5.50
         8.23
                                   36.00
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
GRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (Y,Y,Z)--
8.23 5.50
         8.23
                                   36.00
                      10.00
         0.00
CONTROL NAME -
         THYD BOOST CIR BK
LOCATION (X,Y,Z) -
```

SERVICE SERVICE SERVICES SERVICED SERVICES SERVI

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-2.38
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
GRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z)--
8.23 -2.38
         8.23
                                   36.00
                     10.00
         0.00
CONTROL NAME -
         * FUEL VALVE HANDLE
LOCATION (X,Y,Z) -
        12.36
                     14.00
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
JRIP (1-CLENCHED, 2-FIRGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (T,Y,Z) -- 12.36 14.00
                                   36.00
        0.00
                     10.00
CONTROL NAME -
         *EMER DOOR REL
LOCATION (X,Y,Z) -
                     18.25
        -9.00
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
GRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) --
                     18.25
        -9.00
                                   29.50
         0.00
                     10.00
CONTROL NAME -
         *CAU TEST/RESET
LOCATION (X,Y,Z) -
                     18.05
        10.81
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
grip(1-clenched, 2-finger tip, 3-extended) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRI HARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) --
       10.81
                     18.05
        0.00
                     10.00
CONTROL NAME -
         *FM RADIO
LOCATION (X,Y,Z) -
```

```
17.55
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
SRIP (1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARMESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,7) -- 6.81 17.55
                                   -2.50
         0.00
                      10.00
CONTROL WARE -
         ADF RECEIVER
LOCATION (X,Y,Z) -
                      22.05
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
GRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) --
         6.81
                     22.05
         0.00
                      10.00
CONTROL NAME -
HIN HEAD CLEARANCE -
        0.00
HELBET THICKNESS -
        0.00
HEAD CLEARANCE COORDINATES (X,Y,Z) -
CREW FUNCTIONS (1-IMPUT, 2-PRINT, 3-RDIT, 4-SAVE, 5-END) --
PRINT HODE (1-DESC, 2-ANCHOR, 3-DEP, 4-SEAT, 5-CONTROL, 6-HEAD, 7-HAC, 8-ALL, 9-END) --
CREW STATION DESCRIPTION -
                                          *OH-58A COCKPIT-COPILOT*
ANCHORAGE -
DESIGN EYE POINT:
                                           0.00
                                                     3.90
                                                              33.03
DEP IN UP DIRECTION (X,Y,7) -
DEP IN FORWARD DIRECTION (X,Y,7)
                                           0.00
                                                     3.90
                                                              43.03
                                                    13.90
                                           0.00
                                                              33.03
LINE OF SIGHT ANGLE -
SEAT DATA:
SEAT BACK ANGLE -
                                           9.00
SEAT PAN ANGI.E -
                                          8.00
                                          50.00
SEAT REF POINT DOWN-BACK(X,Y,Z) -
                                           0.00
                                                     0.00
                                                               0.00
SEAT UP-BACK (X,Y,7) -
                                          0.00
                                                     0.00
                                                               0.00
SEAT DOWN-FORWARD (X, Y, Z) -
                                                     0.00
                                          0.00
                                                               0.00
```

CONTROLS:

W D	CONTROL NAME CYCLIC	BODY	HARN	GRIP	PRIM NON-P	Too	NOITA:	z
. 1	CYCLIC	RII	UNLK	CLEN	PRIM	0.00	19.50	11.61
_	COLLECTIVE RT ANTITORQUE PED					0.00	25.55	10.76
2	COLLECTIVE	T H	リドレス	CLEN	PRIM	-10.80	17.30	0.00
						-10.80	12.47	8.75
3	RT ANTITORQUE PED	n P			BEIZ	4.00	32.65	-6.26
						4.00	42.15	-/./6
4	LFT ANTITORQUE PED	LF			PRIM	- D. DO	32.00	-0.20
	P# P				W D W - D	-5.50	20 00	7.10
3	PUBL BOOST SW	Ln	UMLK	BATT	#U#-P	19.40	30.00	7.13
6	CODILOT TOS SELECT	18	RMIR	PTTD	#3#-D	-2 77	30.00	6 6 3
•	COLUMN TO SOURCE	411	0 1711	F 1 1 F	n./n-2	-2.77	30.00	6 63
7	FORCE TRIM SW	T.#	II N L. K	RTTP	MON-P	18.48	30.00	10.13
•	FORCE TRIM SW	4744	0 11211	una:	***	18.48	30-00	10.13
8	HYD BOOST SW	L H	UNLK	PTIP	NON-P	19.48	30.00	10.13
			••			19.48	30.00	10-13
9	ALT SET KNOB	LĦ	DNLK	FTIP	HON-P	17. 23	30.00	15.13
						17. 23	30.00	15.13
10	UHP RADIO	LĦ	UNLK	FTIP	Y-WCM	7.04	30.00	4.63
	UHP RADIO					7.04	30.00	4.63
11	VHF RADIO	LH	UNLK	FTIP	MUM-6	0.48	30.00	11.13
						A 40	20 01	44 42
12	TRANSPONDER	LĦ	UNLK	FTIP	MON-B	0.48	30.00	16.13
						0.48	30.30	16.13
13	CLOCK	LH	UNLK	PXTP	q-KCK	12. 23	30.00	22.13
						12.23 12.23	30.00	22.13
14	INVERTER SW	LH	UNCK	EXTE	non-p	10.11	11.50	36.00
	51 5 40 1 4 4 4 A					10.11	11.50	36.00
	BAT/GEN SWS							
40	BAH 3 AH AWBUD	• ••	~ ~ ~			8.23	11.50	30.00
10	ROW 2 Sw. OARUD	LH	O MI'K	EXTF	, ע-אנא	0.23	9.13	36.00
17	DOU 3 CU OUDUN			<b>PY</b> # P	W 3 W D	0 22	7.13	36.00
• • •	BOW 5 SW, OVERD	1413	חבו זו ני	DATE	1-11CH	8 23	0 13	36.00
18	ROW 2 SW, OWRHD  ROW 3 SW, OWRHD  LGT CONT KNOBS	1. 14	N N L E	PTID	MUN-D	8.23	5.50	36.00
	DOI COMI KNODO	211	O M D II		WOW E	8 23	5.50	36.00
19	HYD BOOST CIR BK	1.14	N WT.K	PTIP	MON-P	8. 23	-2.38	36.00
• •		•	0 11 211			8-23	-2.38	36.00
20	FUEL VARVE HANDLE	LH	UNLK	CLEN	NON-P	12.36	14.00	36.00
	•					12.36	14.00	36.00
21	EMER DOOR REL	LĦ	UNLK	CLEN	Q-NCM	-9.00	18.25	29.50
						- a. nn	18 25	29 50
22	CAU TEST/RESET	LH	UNLK	FXTF	NON-P	10.81	18.05	-2.50
						10.81	18.05	-2.50
23	PM RADIO	LH	UNLK	FTIP	M - M C W	6.81	17.55	-2.50
						6. 81	17.55	-2.50
24	ADF RECEIVER	T. FI	UNLK	FTIP	M D M - P	6.81	22.05	-2.50
_						6.81	22.05	-2.50
					~~~~~			

HEAD CLEARANCE:
HIN HEAD CLEARANCE - 0.00
HELMET THICKNESS - 0.00
HEAD CLEARANCE COORDINATES (X,Y,Z) - 0.00 0.00

CREW FUNCTIONS (1-INPUT, 2-PRINT, 3-EDIT, 4-SAVE, 5-END) -4
ENTER FILENAME FOR CREWSTATION ANALYSIS -'OH58A'
\*\*\*CREWSTATION DATA IS SAVED ON FILE:

CRRW PUNCTIONS (1-INPUT, 2-PRINT, 3-PDIT, 4-SAVE, 5-PND) -- 5
CAR (1-)PER SAMPLE, 2-CREWSTATION, 3-ACCOM ANALYSIS, 4-REACH ENV, 5-END) -- 5

END OF CAR HODEL

# APPENDIX D

OH-58A COCKPIT-OBSERVER

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CREWSTATION ASSESSMENT OF REACH (CAR) HODEL
CAR (1-OPER SAMPLE, 2-CREWSTATION, 3-ACCOR ANALYSIS, 4-REACH ENV, 5-END) -- 2
CRRH FUNCTIONS (1-INPUT, 2-PRINT, 3-EDJT, 4-SAVP, 5-END) --
INPUT HODE (1=INTERACTIVE; 2=FILE) --
CREW STATION DESCRIPTION -
           "OH-58A COCKPIT-OBS"
ANCHORAGE (1-DEP, 2-SEAT, 3-FOOT SEATED, 4-FOOT STAND,
  5-HIP, 6-SHOULDER-SEATED, 7-SHOULDER-STAND) ?--
DESIGN MYR POINT:
DEP (X,Y,Z)
     0.00
               3.90
                        33.03
DEP IN UP DIRECTION (X,Y,Z) -
     0.00
               3.90
                        43.03
DEP IN FORWARD DIRECTION(X,Y,Z)
     0.00
             13.90
                        33.03
LINE OF STGHT ANGLE -
     -13.00
SEAT BACK ANGLE -
       9.00
SEAT PAN ANGLE -
       B.00
HARNESS % -
      50.00
SEAT REP POINT DOWN-BACK(X,Y,Z) -
        0.00
                     0.00
CONTROL NAME -
          CYCLIC
LOCATION (X,Y,Z) -
                    19.50
        0.00
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
GRIP (1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIBARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z)--
0.00 25.55
                                 10.76
                     10.00
        6.11
CONTROL NAME -
         COLLECTIVE
LOCATION (X,Y,Z) -
                    17.30
                                  0.00
      -10.30
BODY PART (1-14,2-84,3-84,4-17,5-87,6-87)--
GRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
```

HARNESS (1-LOCK, 2-UNLOCK) --

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PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) --
-10.80 12.47
                                    8.75
         9.99
                     10.00
CONTROL NAME -
          *PT ANTITORQUE PED
LOCATION (X,Y,Z) -
                     32.65
         4.00
                                   -6.26
BODY PART (1-LH, 2-RH, 3-BH, 4-LP, 5-RF, 6-BF) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) --
         4.00
                    42.15
                                   -7.76
         9.62
                     130.00
CONTROL NAME -
          *LFT ANTITORQUE PFD
LOCATION (X,Y,Z) - 32.65
                                  -6.26
BODY PART (1-LH, 2-RH, 3-BH, 4-LP, 5-RF, 6-BF) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z)--
+5.50 42.15
        -5.50
        9.62
                     10.00
CONTROL NAME -
          *FUEL BOOST SW
LOCATION (X,Y,Z) -
                     30.00
       19.48
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
JRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-INLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) --
       19.48
                     30.00
                                   7.13
        0.00
                     10.00
CONTROL MANR - COPILOT ICS SZLECT
LOCATION (X,Y,Z) - 30.00
                                   6.63
BODY PART (1-LH, 2-RH, 3-BH, 4-LP, 5-RF, 6-BF) --
GRIP(1-CLENCHED, 2-FINGER TIP, 3-MXTENDED) --
MARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z)--
       -2.77
                     30.00
                                   6.63
         0.00
                     10.00
CONTROL NAME - POPCE TRIM SW
LOCATION (X,Y,%) -
```

```
30.00
                                   10.13
        18.48
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-RF) --
GRIP(1-CLENCHED, 2-PINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (T,Y,Z) --
                     30.00
                                   10.13
         0.00
                      10.00
CONTROL NAME -
         THYD BOOST SW
LOCATION (X,Y,Z) -
                     30.00
        19.48
                                   10.13
BODY PART (1-LH, 2-RH, 3-BH, 4-LP, 5-RF, 6-BF) --
GRIP (1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) --
        19.48
                     30.00
                                   10.13
         0.00
                      10.00
CONTROL NAME -
         'ALT SET KNOB
LOCATION (X,Y,Z) - 17.23
                     30.00
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
GRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z)--
17.23 30.00
                                   15.13
         0.00
                     10.00
CONTROL NAME -
         'URP RADIO
LOCATION (X,Y,Z) -
         7.04
                     30.00
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
SRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) -- 7.04 30.00
         7.04
                                    4.63
         0.00
                     10.00
CONTROL NAME -
         'VHP RADIO
LOCATION (X,Y,Z) -
```

```
30.00
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
GRIP (1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) --
        0.48
                    30.00
                                 11.13
        0.00
                    10.00
CONTROL WANT -
         TRANSPONDER
LOCATION (X,Y,Z) -
                   30.00
        0.48
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
GRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) --
        0.48
                    30.00
                                  16.13
        0.00
                    10.00
CONTROL NAME -
        *CLOCK
LOCATION (X,Y,Z) -
       12.23
                   30.00
                                 22.13
BODY PART (1-LH, 2-RH, 3-BH, 4-LP, 5-RF, 6-BF) --
grip(1-clenched, 2-ringer Tip, 3-extended) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIBARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) --
               30.00
                                 22.13
       12.23
        0.00
                    10.00
CONTROL NAME -
        *INVERTER SW
LOCATION (I,Y,Z) -
                    11,50
                                 36.00
       10.11
BODY PART (1-LH, 2-RH, 3-BH, 4-LY, 5-RY, 6-BY) --
GRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) --
                    11.50
                                 36.00
       10.11
        0.00
                    10.00
CONTROL NAME -
        BAT/GEN SWS
LOCATION (X,Y,Z) -
```

```
8.23
                      11.50
                                    36.00
 BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
 GRIP(1-CLENCHED, 2-PINGER TIP, 3-RXTENDED) --
 HARNESS (1-LOCK, 2-UNLOCK) --
 PRIHARY (1-YES, 2-NO) --
 ADJUSTABLE LOCATION (X,Y,Z)--
          8.23
                      11.50
                                    36.00
          0.00
                      10.00
 CONTROL WAME -
          TPOW 2 SW. OVRHD
 LOCATION (X,Y,Z) -
                      9.13
         8.23
                                    36.00
 BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
JRIP (1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z)--
8.23 9.13
                                   36.00
         0.00
                      10.00
CONTROL NAME -
         TROW 3 SW, OVRHD
LOCATION (X,Y,Z) -
         8.23
                      7.75
BODY PART (1-LH, 2-RH, 3-BH, 4-LP, 5-RF, 6-BF) --
GRIP(1-CLENCHED, 2-FINGER TIP, 3-FITENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z)--
8.23 9.13
                                   36.00
         1.38
                     10.00
CONTROL NAME -
         *LGT CONT KNOBS
LOCATION (X,Y,Z) -
                      5,,50
                                   36.00
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, G-BF) --
GRIP(1-CLENCHED, 2-PINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1- TES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) -- 8.23 5.50
                                   36.00
         0.00
                     10.00
CONTROL NAME -
         *HYD BOOST CIP BK
LOCATION (X,Y,Z) -
```

```
8.23
                     -2.38
BODY PART (1-LH, 2-RH, 3-BH, 4-LP, 5-RP, 6-BF) --
GRIP (1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z)--8.23 -2.38
                                   36.00
         0.00
                     10.00
CONTROL NAME -
         FUEL VALVE HANDLE
LOCATION (X,Y,Z) -
        12.36
                     14.00
                                   36.00
BODY PART (1-LH, 2-RH, 3-BH, 4-LP, 5-RF, 6-BF) --
GRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) ---
PRIMARY (1-TES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) --
                                   36.00
        12.36
                     14.00
         0.00
                     10.00
CONTROL NAME -
         *ERER DOOR REL
LOCATION (X,Y,Z) -
                     18.25
                                  29.50
       -9.00
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
GRIP (1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
   ISTABLE LOCATION (X,Y,Z) -- -9.00 18.25
                                   29.50
         0.00
                     10.00
CONTROL NAME -
         'CAU TEST/RESET
LOCATION (X, Y Z) -
       10. É
                     18.05
RODY PART (1-.
               `-RH,3-BH,4-LP,5-RF,6-BF)--
      1-CLENCHE
                  LNGRR TIP, 3-EXTENDED) --
HARMESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z)--
10.81 18.05
                                  -2.50
        10.81
         0.00
                     10.00
CONTROL NAME -
         'PH RADIO
LOCATION (X,Y,Z) -
```

```
17.55
BODY PART (1-LH, 2-RH, 3-BH, 4-LP, 5-RP, 6-BF) --
GRIP(1-CLENCHED, 2-FINGER TIP, 3-EXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-TES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z)---
6.81 17.55
                                   -2.50
         0.00
                     10.00
CONTROL NAME -
         ADP PECEIVER
LOCATION (X,Y,Z) -
         6.81
                     22.05
BODY PART (1-LH, 2-RH, 3-BH, 4-LF, 5-RF, 6-BF) --
GRIP(1-CLENCHED, 2-FINGER TIP, 3-FXTENDED) --
HARNESS (1-LOCK, 2-UNLOCK) --
PRIMARY (1-YES, 2-NO) --
ADJUSTABLE LOCATION (X,Y,Z) --
                     22.05
                                   -2.50
                     10.00
         0.00
CONTROL NAME -
HIN HEAD CLEARANCE -
       0.00
BELHET THICKNESS -
       0.00
HEAD CLEARANCE COOPDINATES (X,Y,Z) -
                                   0.00
         0.00
                      0.00
CREW FUNCTIONS (1-INPUT, 2-PRINT, 3-EDIT, 4-SAVE, 5-END) --
PRINT HODE (1-DESC, 2-ANCHOR, 3-DEP, 4-SEAT, 5-CONTROL, 6-HEAD, 7-HAC, 8-ALL, 9-END) --
CREW STATION DESCRIPTION -
                                         OH-58A COCKPIT-OBS
ANCHORAGE -
                                         SEAT
DESIGN EYE POINT:
DEP(X,Y,Z) -
                                          0.00
                                                    3.90
                                                             33.03
DEP IN TP DIRECTION (X,Y,Z) -
DEP IN FORWARD DIRECTION (X,Y,Z) -
                                          0.00
                                                    3.90
                                                             43.03
                                          0.00
                                                   13.90
                                                             33.03
LINE OF SIGHT ANGLE -
                                        -13.00
SEAT DATA:
                                          9.00
STAT BACK ANGLE -
SEAT PAN ANGLE -
                                          8.00
HARNESS % -
                                         50.00
                                                    0.00
                                                              0.00
SEAT REF POINT DOWN-BACK(X,Y,Z) -
                                          0.00
SEAT UP-BACK(X,Y,Z) -
                                          0.00
                                                    0.00
                                                              0.00
                                          0.00
                                                    0.00
                                                              0.00
SEAT DOWN-PORWARD (X,Y,Z) -
CONTROLS:
```

HO.	CONTROL NAME	BODY	HARN	CRYP	PPIN	LOC	NOITA:	Z
				-		*****		
1	CYCLIC	PR	UNLK	CLEN	PRIN	0.00	19.50	11.61
						0.00	25.55	10.76
2	COLLECTIVE	LH	UNLK	CLEN	PRIM	-10.80	17.30	0.00
_						-10.80	12.47	8.75
3	DAM SUDUCTION TH	RF			PRIM	4.00	32.65	-6.26
						4.00	42.15	-7.76
4	LFT ANYITORQUE PED	LF			PFIN	-5.50 -5.50	32.65	-6.26 -7.76
•	FUEL BOOST SW	0.0	nutr	<b>PY</b> ##	MOM-P	10 40	42.15	7 13
,	TOEL BOOM! SW	KIL	MATU	DAIL	WUM-1	19.48 19.48 -2.77 -2.77	30.00	7.13
6	COPILOT ICS SELECT	1.H	WMI.K	PTIP	NON-P	-2.77	30.00	6.63
			• •			-2.77	30.00	6.63
7	PORCE TRIM SW	ĦĦ	WHIE	EXTE	NOH-P	18.48	30.00	10.13
						18.48		10.13
8	HYD BOOST SW	RH	UNLK	FTIP	MON-P	19.48	30.00	10.13
						19.48	30.00	10.13
9	ALT SET KNOB	RS	UNLK	PTIP	No M - B	17.23	30.00	15.13
						17.23		15.13
10	UHP RADIO	RH	UNLK	PTIP	NON-P	7.04	30.03	4.63 4.63
	****					7.04		
11	VHP PADIO	RH	UNLK	FTIP	NON-P	0.48	30.00	11.13
12	TRANSPONDER	24	****	WAT D	MAN. D	0.48	30.00 30.00	11.13
12	TRANSPORU OR	W D	ONLK	FLIP	4114 - 5	0.48 0.48	30.00	
13	CLOCK	bн	HWT.K	RYTH	MUN-D	12.23	30.00	22.13
1.5	COOCH	4(37	UNZK	DAIL	NON-P	12.23	30.00	
14	INVERTER SW	RH	UNLK	EXTF	NON-P	10.11	11.50	36.00
• •		****				10.11	11.50	36.00
15	BAT/GEN SWS	RH	UNLK	EXTF	NOH-P	8.23		36.00
							44 50	36.00
16	ROW 2 SW, OVRHD	RH	UNLK	EXTF	NON-P.	8.23	9.13	36.00
_						8.23	9.13	16.00
17	ROW 3 SW, OWRHD	RH	UNLK	FXTF	NON-P	8.23	7.75	36.00
	ROW 2 SW, OVRHD ROW 3 SW, OVRHD LGT CONT KNOBS					8.23	9.13	36.00
18	LGT CONT KNOBS	RH	UNLK	FTIP	MOM-P	8.23 8.23	5.50	36.00
10	HYD BOOST CIR BK	D ##	TI MT V	<b>987</b> N	MAN-B	0.23	5.50 -2.38	36.00 36.00
17	HID BUOST CIR BK	T II	OUTV	FILE	NUN-P	8.23	-2.38	36.00
20	FUEL VALVE HANDLE	D tr	DMTE	CIPN	MON-P	12 36	14.00	36.00
20	TODE TREY! HANDE!	" 1)	ONAN	CALK	NON-E		14.00	36.00
21	EMEP DOOR REL	LĦ	UNLK	CLEN	MON-P			29.50
						-9.00	18.25	29.50
22	CAU TEST/RESET	RH	ONLK	EXTP	MON-P	10.81	18.05	-2.50
						10.81	18.05	
23	PN RADIO	RH	UNLK	PTIP	Non-P	6.81	17.55	-2.50
						6.81	17.55	-2.50
24	ADP RECEIVER	RH	UNLK	FTIP	MON-P			
						6.81	22.05	

できない。 「おおから」にも必要ない。 「は、これではないできない。 「おいからないできない。」というできない。 「おいからないできない。」というできない。 「おいからないできない。」というできない。 「おいからないできない。」というできない。 「おいからないできない。」というできない。

HEAD CLEARANCE:
HIN HEAD CLEAPANCE - 0.00
HELMET THICKNESS - 0.00
HEAD CLEAPANCE COORDINATES (X,Y,Z) - 0.00 0.00

CREW PUNCTIONS (1-IMPUT, 2-PRINT, 3-HDIT, 4-SAVE, 5-HND)-
4

BHTER PILENAME POR CREWSTATION ANALYSTS -
10H 58A'

\*\*\*CREWSTATION DATA IS SAVED ON PILE:

CREW PUNCTIONS (1-INPUT, 2-PRINT, 3-HDIT, 4-SAVE, 5-RHD)-
5

CAR (1-OPER SAMPLE, 2-CREWSTATION, 3-ACCOM ANALYSIS, 4-REACH ENV, 5-EMD)-
5

END OF CAR MODEL

### APPENDIX E

MEANS, STANDARD DEVIATIONS AND CORRELATION MATRIX

CPENSTARION ASSESSMENT OF REACH (CAP) NODEL

CAR (1-DPER SAMPLE, 2-CREWSTATION, 3-ACCOM ANALYSIS, 4-REACH ENV,5-END) -DPER SAMPLE DPT (1-GENERATE SAMPLE, 2-ACTUAL OPER MEAS, 3-END)

GENERATE PUNCTIONS (1-INPUT; 2-EDIT; 3-SAVE; 4-PRINT; 5-GENERATE; 6-END) -INPUT MDDE (1=INTERACTIVE; 2=FILE) --

DIAGNOSTICS OF FORMATTED PRAD

CORRELATION/ANTHROPOMETRIC MEASUREMENTS:

+++TOTAL BEROPS ON INPUT DATA

GRMERATE FUNCTIONS(1-INPUT;2-EDIT;3-SAVE;4-PRINT;5-GENERATE;6-END)-
4

PRINT FODE(1-MEAN/STD;2-COR HATRX;3-OPFR HEAS;4-LINK LENG;5-END)--

'ARMY AVIATORS'

HEARS AND STANDARD DEVIATIONS (IN INCHES)

MEASUREMENT	MEANS	STD DEV	
1-STATURE	68.72	2.49	
2-WAIST REIGHT	41.75	1.99	
3-SITTING HEIGHT	35.80	1.27	
4-EVE HEIGHT-SITTING	31.02	1.25	
5-POPLITEAL HPIGHT-SITTING	16.67	0.97	
6-BUTIOCK-KNEE LENGTH	23.70	1.04	
7-SHOULDER-ELBOW LENGTH	14.45	0.70	
8-POREARM-HAND LENGTH	18.95	0.83	
9-BIDFLTOID DIAMETER	18.66	1.01	
10-HIP BREADTH	13.83	0.84	
11-FOOT LENSTH	10.43	0.50	•
12-HAND LENGTH	7.56	0.34	

PRINT HODE (1-HEAH/SID; 2-COR HATRX; 3-OPER HEAS; 4-LINK LENG; 5-END) -- 2

'ARBY AVIATORS'

CORPELATION MATRIX

						_	FORE			•	
1	2	3	4	5	6	7	8	9	10	11	12
	0.905	0.760	0.734 0.533	0.774 0.813	0.774 0.781	0.676 0.669	0.762 0.761 0.472	0.327 0.271	0.411	0.661	0.600

PRINT HODE (1-HEAN/STD; 2-COR MATRX; 3-OPER HEAS; 4-LINK LENG; 5-BND) -5
GENERATE FUNCTIONS (1-INPUT; 2-EDIT; 3-SAVE; 4-PRINT; 5-GENERATE; 6-END) -6
OPER SAMPLE OPT (1-GENERATE SAMPLE, 2-ACTUAL OPER HEAS, 3-END)
3
END OF OPERATOR SAMPLE
CAR (1-OPER SAMPLE, 2-CREWSTATION, 3-ACCOM ANALYSIS, 4-REACH ENV, 5-END) -5

END OF CAR MODEL

### APPENDIX F

CREWSTATION ANALYSIS-PILOT

#### CREVSTATION ASSESSMENT OF REACH (CAR) HODEL

```
CAR (1-OPER SAMPLE, 2-CREWSTATION, 3-ACCOM ANALYSIS, 4-REACH ENV, 5-END) --
  INDICATE WHICH CONTROLS ARE TO BE ANALYZED (0=ALL; N, H=RANGE) --
  SAMPLE SIZE (O=ALL: M, M=RANGE) ---
     50
  DISPLAY OPERATOR IDS FOR REACH FAILURE (0-NO, 1-YES) --
  RESTRICT SAMPLE BASED UPON HEAS PERCENTILES (0-MO,1-YES)---
  ENTER LOWER AND UPPER PERCENTILE VALUES --
  CLOTHING (1-NOME: 2-SUMMER: 3-WINTER) --
  AMALYSIS OPTION (1-ALL OPERATORS, 2-OPERATORS ON LOS ONLY) --
  REACH ALGORITHM (1=PASS THROUGH CONTROL, 2-TERMINATE AT CONTROL) --
***OPERATOR NO:
                   1 PALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
                   5 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT: 6 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
*** CPERATOR NO:
:cw sorassoe ...
***OPERATOR NO:
                   7 PALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
                  11 PALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
12 PALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
***OPERATOR NO:
***OPERATOR NO:
***OPERATOR NO:
                  13 PALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
                  14 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
***OPERATOR NO:
                  15 FALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                  22 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
                  24 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
:ch norango***
***OPERATOR NO:
                  28 FALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
***OPERATOR NO:
                  30 FALLS OUTSIDE HEAS BANGE *** FOR HEASUREMENT:
:CK GOTASSGO+++
                  34 FALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                  36 PALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                  37 FALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
:CM SOTASSOO***
                  39 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
*CH ROTARSO**
                  40 FALLS OUTSIDE HEAS RANGE *** FOR HEASUBEMENT:
***OPERATOR NO:
                  43 FALLS OUTSIDE MEAS BANGE *** FOR MEASUREMENT:
:CH ROTARSO+++
                  44 PALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO: 46 FALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
```

# CREWSTATION ASSESSMENT OF REACH

SAMPLE: ARMY AVIA TORS FILE:

OPERATOR NOS: 1-50
MEASUREMENT: STATURE PERCENTILE: 5-95
WO OPER ANALYZED: 29

CLOTHING: SUMMER

CREWSTATION: OH-58A COC RPIT-PILOT FILE: MEAS/ST

ANCHORAGE: SEAT

بعارجته حياري معارسا مناسبه والمعارسة والمعارسة والمعارسة والمعارسة والمعارضة والمعارض

DEP: SEAT BACK: TRACKS:

DOWN BACK:

0.00 3.90 33.03 9.00

LEPT RIGHT

0.00 0.00 0.00

LOS AMGLE: -13.0 SEAT PAN: 8.0 HARNESS: 50.8

BRACH ALGORITHM: TERMINATE AT CONTROL

VISION ACCOMMODATION

LINE OF SIGHT ABOVE BELOW ON \* 0.00 0.00 0.00 0.00 79.31 0.00 0.00 0.00 0.00 20.69 FORWARD OF DEP 2. 13 0. 32 BEHIND DEP

AVERAGE VERTICAL AND HORIZONTAL DISPLACEMENT FROM DEP -1.74 0.19

AVERAGE VERTICAL AND HORIZONTAL DISPLACEMENT FROM SEAT DB

PERCENTAGE OF CREWPEOPLE ACCOMMODATED

POSITION TO VISION POINT

VISION POINTEREACH CONTROLS

REACH CONTROLS

0.00 .

ALL CONTROLS PRIMARY ONLY ZONE163 ZONE263 ZONE163 ZUNE263 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

CONTROL SUMMARY

LOCATION/ HAND HARN REQUIRED NOVEMENT CONTROL NAME POOT LOCK GRIP X Y Z 1+CYCLIC RH UNLK CLEN 0.0 19.5 11.0 ZONES ACCOMODATED 100 LH UNLK CLEN -10.8 17.3 0.0 2\*COLLECTIVE ZONES ACCOMODATED 100 -10.8 12.5 8.8 ADJUSTABLE LOCATION ZONES ACCOMODATED 100

BOTH ENDS

ZOWES ACCOMODATED						
3*RT ANTITORQUE PED ZONE3 ACCOMODATED ANG LIMITS	34 65	RF	4.0	32.6	-6.3	
ADJUSTABLE LOCATION ZONES ACCOMODATED	0	4.0	42.1	-7.8		
TOO PAR	100	AVERAGE Worse Case	-1.4 -2.2	-2.9 -4.6	0. U -0. 1	3. 2 5. 1
BOTH ENDS	_					
ZONES ACCOMODATED TOO FAR	100				<b></b>	
4°LFT ANTITORQUE PED ZONES ACCOMODATED	100	LP		32.6		
ADJUSTABLE LOCATION ZONES ACCOMODATED	0	-5.5	42.1	-7.8		
TOO FAR	100	AVERAGE Worse Case	1. 1 1.9	-2.4 -4.1	-0.1 -0.2	2.7 4.6
BOTH ENDS						
ZONES ACCOMODATED TOO PAR	100					
5 FUEL BOOST SW ZONES ACCOMODATED		LH UNLK EXTP	-0.9	30.0	7.1	
ADJUSTABLE LOCATION ZONES ACCOMODATED	10 0	-0.9	30.0	7.1		
BOTH ENDS 20NE3 ACCOMODATED						
6 PILOT ICS SELECT ZONES ACCOMODATED		LH UNLK PTIP				
TOO FAR	10	AVERAGE Worse Case	0.0 0.0	-0.2 -0.3	0.1 0.2	0.2 0.3
ADJUSTABLE LOCATION		-4.1	30.0	6.6		
ZONES ACCOMODATED TOO PAR	89 10	AVERAGE Worse Case	0.0 0.0	-0.2 -0.3	0.1 0.2	0.2 0.3
BOTH ENDS ZONES ACCOMODATED TOO FAR	89 10					,
7 FORCE TRIM SW ZONES ACCOMODATED	100	LH UNLK EXTP				-
ADJUSTABLE LOCATION ZONES ACCOMODATED	100	-1.9	30.0	10.1		
BOTE ENDS ZONES ACCOMODATED	100					
8 HYD BOOST SW		LH UNLK PTIP				

	zon e 3	ACCOMODATED	100						
A DJ U	STABLE ZONE3	LOCATION ACCOMODATED	10 0		~0.9	30.0	10. 1		
		ACCOMODATED							
9 A	LT SET			LH	ONTK LLID				
A DJ U	STABLE ZONE3	LOCATION ACCOMODATED	100		-3.1	30.0	15. 1		
BOTH	ends Zone3	ACCONODATED							
10 0	HP RAD	IO ACCOMODATED		LH	UNLK FTIP				
	20 8 23	TOO PAR	24	NORS	AGE E CASE	0.1 0.1	-0.4 -0.6	0.3 0.5	0. ! U. !
A DJ U	STABLE	LOCATION ACCOMUDATED	26		-13.3	30.0	4.6		
	20#23	TOO PAR	24	AVER	AGE B CASE	0.1 0.1	-0.4 -0.6	0.3 0.5	0- : 0- :
BOTH		ACCOMODATED TOO FAR	24						
	HP RADI	TO ACCOMODATED		LH	UNLK FTIP				
A DJ U	STABLE ZONE3	LOCATION ACCOMODATED	100		-19.9	30.0	11.1		
BOTH	ENDS ZONES	ACCOMODATED							
12 TI	RANSPOI Zon e3				UNLK FTIP				
		LOCATION ACCOMODATED			-19.9	30.0	16. 1		
		ACCONODATED	_						
13 CI	LOCK				UNLK EXTP				
A DJ US		LOCATION ACCOMODATED	100		-8.1	30.0	22. 1		
BOTH	ENDS ZONE3	ACCOMODATED	100						
14 11	vertee zon 23	SW ACCOMODATED	10 0	LH	UNLK EXTP	-10.3	11.5	36.0	-

	LOCATION ACCOMODATED	100		-10.3	11.5	36.0	
BOTH ENDS ZONE3	ACCOMODATED	100					
15 BAT/GEN	SWS ACCOHODATED	•	LH	UNLK EXTF	-12.1	11.5	36.0
A DJ USTA B LE ZON E 3	LOCATION ACCOMODATED	100		-12.1	11.5	36.0	
	ACCOMODATED						
16 ROW 2 S	W, OVEHD ACCOMODATED			ONLK EXTF			
ZON B3	ACCOMODATED	89					
	ANG LINITS	10					
ADJUSTABLE	LOCATION			-12.1	9.1	36.0	
ZON E3	LOCATION ACCOMODATED ANG LIMITS	89 10					
	2.0 22.1.1.5						
BOTH ENDS		0.0					
20 N E 3	ACCOMODATED Too Par	10					
17 ROW 3 S	W, OVRHD ACCOMODATED ANG LIMITS	46	LH	UNLK EXTF	-12-1	7.8	36.0
20 # E3	ANG LIMITS	34					
		-					
ADJUSTABLE	LOCATION	0.0		-12.1	9.1	36.0	
20 N E 3	ACCOMODATED ANG LINITS	10					
BOTH ENDS	1.CC0M001.MB0						
	ACCOMODATED TOO FAR						
18 LGT CON	r khobs Accomodated	6.2	LH	UNLK PTIP	-12.1	5.5	36.0
20123	ANG LIMITS	6					
						24.5	
	LOCATION ACCOMODATED	<b>Q</b> 3		-12.1	5.5	36.0	
201123	ANG LIMITS	6					
							_
BOTH ENDS	ACCOMODATED	9.3					•
	TOO PAR						
	T CIR BK			UNLK PTIP			
	ACCOMODATED	75	L II	OMEN PATE	-14.1	-2.4	30.0
	ANG LIMITS						
4 D 17/2 D 1 D 1 =	10010104			-12.1	-2 H	36.0	
ADJUSTABLE ZONE3	ACCOMODATED	75		- 14.1	-4.4	JU. V	
	ANG LIMITS	24					

2020									
	SON E3	ACCOMODATED TOO FAR	24						
20 PU	EL VAL	YE HANDLE ACCOMODATED		TH	ONTK CIBM	~8.0	14.0	36.0	
		LOCATION ACCOMODATED	10 0		-8.0	14.0	36.0		
BOTH	ZONE3	ACCOMODATED							
	ER DOC	R REL ACCOMODATED		RH	ONTK CTER	9.0	18.3	29.5	
		LOCATION ACCOMODATED	10 0		9.0	18.3	29.5		
	ZONE3	ACCOHODATED							
22 CA	TEST	RESET ACCOHODATED			UNLK EXTP				-
A DJ US	Table Zone3	LOCATION ACCORODATED	100		-9.6	18.1	-2.5		
	ZONES	ACCOHODATED							
23 PM	RADIO	ACCOHODATED			ONLK FTIP				
		LOCATION ACCOHODATED	100		-13.6	17.6	-2.5		
BOTH		ACCOHODATED	100						
	RECE				UNLK PTIP	-13.6	22.1	-2.5	
;		ACCOHODATED TOO FAR	96 3	AVER	AGE E case	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0
		LOCATION	0.6		-13.6	22.1	-2.5		
•		ACCOMODATED TOO FAR	9 6 3	AVER Wors	AGE E case	0.0 0.0	0.0	0-0 0-0	0.0 0.0
	CON E3	ACCOMODATED TOO FAR	96 3						

CAR (1-OPER SAMPLE, 2-CREWSTATION, 3-ACCOM ANALYSIS, 4-REACH ENV, 5-END) --

END OF CAR HODEL

### APPENDIX G

### CREWSTATION ANALYSIS-COPILOT

○ あるのでないが新し起からがある。● かってきるがったいというからないがら、からからできるというと思うななるです。

ad named managed passed becased washed report beased to

#### CREWSTATION ASSESSMENT OF REACH (CAR) MODEL

```
CAR (1-oper sample, 2-crewstation, 3-accon analysis, 4-reach RNV, 5-bHD) --
  INDICATE WHICH CONTROLS APR TO BE ANALYZED (0=ALL:N. H=RANGE) --
  SAMPLE SIZE (O=ALL; W, M=RANGP) --
    50
  DISPLAY OPERATOR IDS FOR REACH FAILURE (0-NO. 1-YES) --
  RESTRICT SAMPLE BASED OPON MEAS PERCENTILES (0-NO, 1-YES) ---
  ENTER LOWER AND UPPER PERCENTILE VALUES --
  CLOTHING (1-HONE: 2-SUMMER: 3-WINTER) --
  AWALYSIS OPTION (1-ALL OPERATORS, 2-OPERATORS ON LOS OWLY) --
  REACH ALGORITHH (1= PASS THROUGH CONTROL, 2-TERMINATE AT CONTROL) --
:CW ROTARSOO++
                  1 FALLS OUTSIDE HEAS PANGE *** FOR HEASUREMENT:
                  5 PALLS OUTSIDE HEAS PANGE *** FOR HEASUPEMENT:
: CH ROTARSGO***
***OPERATOR #3:
                  6 FALLS OUTSIDE HEAS PANGE *** FOR HEASUREMENT:
                  7 FALLS OUTSIDE MEAS PANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                 11 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
***OPERATOR NO:
                 12 FALLS OUTSIDE MEAS WANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                 13 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
                 14 FALLS OUTSIDE HEAS PANGE *** FOR HEASUREMENT:
***OPEPATOR NO:
***OPERATOR NO:
                 15 TALLS OUTSIDE MEAS
                                        RANGE *** FOR MEASUREMENT:
                 22 FALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                 24 FALLS OUTSIDE MEAS PANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                 28 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
***OPERATOR KO:
:CH ROTAREGO+++
                 30 PAILS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
                 34 FALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
***OPERATOR NO:
                 36 PALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                 37 FALLS OUTSIDE MEAS PANGE *** FOR MEASUREMENT:
***OPERATOR NO:
***OPERATOR NO:
                 39 FALLS OUTSIDE HEAS
                                       RANGE *** FOR MEASUREMENT:
                 40 FALLS OUTSIDE HEAS PANGE ***
***OPERATOR NO:
                                                  FOR MEASUREMENT:
                 43 FALLS OUTSIDE MEAS PANGE *** FOR MEASUREMENT:
***OPPRATOR NO:
                 44 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
* OF ROTARDO ++
                 46 FALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
***OPERATOR NO:
```

## CREWSTATION ASSESSMENT OF PEACH

SAMPLE: ARMY AVIA TORS FILE:

OPERATOR NOS: 1- 50 STATURE PERCENTILE: 5- 95 MEASUREMENT: 29

NO OPER AWALTZED: CLOTHING: SUMMER

OH-58% COC KPIT-COPILOT FILE: MEAS/ST CREWSTATION:

ANCHORAGE: SEAT DEP: SEAT BACK: 0.00 3.90 33.03

LOS ANGLE: SERT PAN: HARNESS:

-13.0 8.0 50.%

TPACKS: DOWN BACK: 9.00 LEFT RIGHT 0.00 0.00 0.00

REACH ALGORITHM: TERMINATE AT CONTROL

VISION ACCOMMODATION

		AB	14 A C	TO THIS	SIGRT	BELOV	!
		*	DIST	ζ	DIST	*	DIST
PORWARD OF BEHIND DEP	DEP	0.00 0.00	0.00	0.00		79.31 20.69	2. 13 0. 32

AVERAGE VERTICAL AND HORIZONTAL DISPLACEMENT FROM DEP

-1.7a

0.19

AVERAGE VERTICAL AND HOTIZONTAL DISPLACEMENT FROM SEAT DB

0.00

PERCENTAGE OF CREWPFOPLE ACCOMMODATED

POSITION TO VISION POINT

0.00

ALL CO	NT ROLS	PRIMARY	ONLY
ZONE163	Zone 283	ZONE153	ZONE253
0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00

REACH CONTPOLS VISION POINTEREACH CONTROLS

## CONTROL SUMMARY

		HAND	SARN		LOCATION/ PROUIPED HOVEMENT			
NO CONTROL NAME	4	FOOT	FOCK	GRIP	x	Y	Z	
1*CYCLIC ZONE3 ACCOMODATE	D 100	RH	UNLK	CLEN	0.0	19.5	11.6	
2*COLLECTIVE ZONE3 ACCOMODATE	D 100	TH	UNLK	CLEN	-10.8	17.3	0.0	
ADJUSTABLE LOCATION ZONE3 ACCOMODATE	p 10 0		-	10.A	12.5	8.8		

BOTH ENDS

70 K W 7	ACCOMODATED	100					
itha tr+e eshes	TORQUE PED ACCOMODATED ANG LIMITS		RP	4_0	32.6	-6.3	
	LOCATION ACCOMODATED	0	4.0	42.1	-7.8		•
	TOO PAR	100	AVERAGE Worse Case	-1.4 -2.2	-2.9 -4.6	0.0 -0.1	3. 2 5. 1
BOTH ENDS ZORES	ACCOHODATED TOO FAR	_					
	TTORQUE PED ACCONODATED		LF		32.6		
	LOCATION ACCOMODATED	0	-5.5	42.1	-7.8		
204 23	TOO FAR	10 0	AVERAGE Worse Case	1.1 1.9	-2.4 -4.1	-0.1 -0.2	2.7 4.6
	ACCOMODATED Too Par	100					
5 FUEL BO	OST SW ACCOMODATED		LII UNLK EXTF	19.5	30.0	7. 1	
20N KJ	TOO PAR	100	AVERAGE Worse Case	-3.0 -3.8	-2.9 -3.7	2. 1 2. 8	4.7 5.0
	LOCATION ACCOMODATED	. 0	19.5				
	TOO FAR	100	AVERAGE Worse Case	-3.0 -3.8	-2.9 -3.7	2. 1	6.0
BOTH ENDS ZONES	ACCOMODATED TOO FAR	100					
	ICS SELECT		LH UNLK PTIP	-2.8	30.0	6.6	
20# 23	ACCOMODATED TOO PAR	24	AVERAGE Worse Case	0.0 -0.1	-0.3 -0.5	0.2 0.4	0.3 0.7
ADJUSTABLE	LOCATION ACCONODATED	75	-2.8	30.0	6.6		
ZUNES	TOO FAR	24	AVERAGE Worse Case		-0.3 -0.5		0.3 0.7
BOTH PNDS							
	ACCOMODATED Too Tar	24					
7 FORCE T	RIM SW ACCOMODATED		LH UWLK EXTP				
• • •	TOO FAR	100	AVERAGE Worse Case		-1.9 -2.6	1. 1 1. 7	2.9 4.1

ADJUSTABLE ZONE3	LOCATION ACCOMODATED TOO PAR	0 10 0	18.5 Average Worse Case	30.0 -1.9	10.1 -1.9	1. 1	2. 9
			WORSE CASE	-2.7	-2.6	1. 7	4, 1
	ACCOMODATED TOO PAR	0 10 0					
8 HYD BOOS	T SW		LH UNLK FTIP				-
ZON E3	ACCOMODATED TOO PAR	100	AVERAGE WORSE CASE	-4.0 -4.7	-3.8 -4.6		6.0 7.2
	LOCATION		19.5	30.0	10.1		
ZON E3	ACCOMODATED TOO PAR	100	AVERAGE Worse Case	-4.0 -4.7	-3.8 -4.6	2.3 2.9	6.0 7.2
BOTH ENDS ZONE3	ACCOMODATED TOO FAR	0 10 0					•
			LH THE FTIP				
ZON E3	ACCOHODATED TOO PAR	0 100	LH OHLK PTIP AVERAGE WORSE CASE	-2.1 -2.9	-2.1 -3.0	0.8 1.1	3. 1 4. 4
ADJUSTABLE	LOCATION		17.2	30.0	15. 1		
ZONZ3	ACCOMODATED TOO PAR	100	AVERAGE Horse Case	-2.1 -2.9	-2.1 -3.0	0.8 1.1	3. 1 4. 4
	ACCOMODATED TOO FAR	100					
10 UHF RADI	0		LH UNLK FTIP	7.0	30.0	4.6	
23 # 23	ACCOMODATED TOO FAR	100	AVERAGE Worse Case	-1.1 -1.7	-2.0 -3.0	1.6 2.4	2.8 4.2
ADJUSTABLE	LOCATION	_	7.0	30.0	4.6		
ZONES	ACCOMODATED TOO FAR	100	AVERAGE WORSE CASE	-1.1 -1.7	-2.0 -3.0	1.6 2.4	2.8 4.2
	ACCOMODATED TOO PAR	0 10 0					
11 VHF RADI ZONE3	O ACCOMODATED	100	IH UNIK PTIP	0.5	30.0	11. 1	
ADJUSTABLE ZON E3	LOCATION ACCOMODATED	100	0.5	30.0	11.1		
	ACCOMODATED			****			

12 TRANSPONDER ZONES ACCOMODATED	100	LR	UNLK PTIP	0-5	30.0	15.1
ADJUSTABLE LOCATION ZONES ACCOMODATED	10 0		0.5	30.0	16. 1	
BOTH ENDS ZONES ACCOMODATED						
13 CLOCK ZORE3 ACCOMODATED		7.11	UNLK EXTF	12.2	30.0	22.1
ADJUSTABLE LOCATION E ZONES ACCOMODATED	10 0		12.2	30.0	22.1	
BOTH ENDS ZONES ACCOMODATED	100		********	^		
14 INVERTER SW CONTROPORTED	100	LH	UNLK EXTP	10.1	11.5	35-0
ADJUSTABLE LOCATION ZONES ACCOMODATED	100		10.1	11.5	36.0	
BOTH ENDS 70NE3 ACCOMODATED			# * <b>• • • • • • • • •</b>	~~~~ <del>~</del>		
15 BAT/GEN SES ZONF3 ACCOMODATED	100	LII	ONLK EXTP	8.2	11.5	35.0
ADJUSTABLE LOCATION 70853 ACCORDATED	10 0		0.2	11.5	36.0	
BOTH ENDS 20NE3 ACCOMODATED						
16 ROW 2 SW, OVERD 20823 ACCOMODATED		LĦ	UNLK EXTP	8.2	9.1	36.0
ADJUSTABLE LOCATION ZONES ACCOMODATED	100		8.2	9.1	36.0	
BOTH ENDS ZONES ACCOMODATED	100			<b>10-0</b>		
17 ROW 3 SW, OVERHO ZONE3 ACCOMODATED		LR	UNLK EXTP	8.2	7.8	36.0
ADJUSTABLE LOCATION ZONES ACCOMODATED	100		8.2	9.1	36.0	,
BOTH ENDS ZONE3 ACCOMODATED	10 0					
18 LGT CONT KNOBS ZONES ACCOMODATED ANG LIMITS	96 3	LH	UNIK PTIP	8.2	5.5	36.0
ADJUSTABLE LOCATION ZONES ACCOMODATED	96		8.2	5.5	36.0	

	ANG LINITS	3						
	ACCOMODATED TOO PAR	9 6 3						
19 HYD ROO ZONES	ST CIP BK ACCOMODATED ANG LIMITS	0 100		UNLK PTIP	8.2	-2.4	35.0	
ZON E3	LOCATION ACCOMODATED ANG LIMITS	0		8.2	-2.4	36.0		
	ACCOMODATED TOO FAR	100						
20 PUEL VAI ZONES	LVE HANDLE ACCOMODATED ANG LIMITS	34	LA	UNLK CLEN				•
ADJUSTABLE ZONES	LOCATION ACCOMODATED ANG LIMITS	34 65		12.4	14.0	36.0		
	ACCOMODATED TOO FAR	65						
21 ENEP DO	OR REL ACCOMODATED		LH	UNIK CLEN				
ADJUSTABLE ZONES	LOCATION ACCOMODATED	100		-9.0	18.3	29.5		
BOTH ENDS ZONE3	ACCOMODATED							
22 CAU TEST ZONES		55 3	LH	UNLK EXTP	10.8	18.1	-2.5	
	TOO FAR	41	AVER	AGE E Case	-0.3 -0.6	-0.2 -0.5	J. 6 1. 1	0.7 1.3
ADJUSTABLE ZONE3	LOCATION ACCOMODATED ANG LIMITS	3			18.1			
	TOO PAR	41	AVER.	AGE B Casp	-0.3 -0.6	-0.2 -0.5	0.6	0.7 1.3
BOTH ENDS ZONF3	ACCOMODATED TOO PAR	55 44						
23 PH RADIO ZONE3	ACCOMODATED	34 65		CHLK FTIP	6.8			- <b>-</b>
	TOO PAR	הט	WORS	E CASE	-0.8			1. 1 2. 1

ADJUSTABLE ZONE3	LOCATION ACCOMODATED	34	6.8	17.6	-2.5		
20463	TOO PAR	65	AVERAGE WORSE CASE	-0.4 -0.8	-0.4 -0.8	0.9 1.8	1. 1 2. 1
BOTH ENDS ZOME3	ACCOMODATED TOO FAR	34 65					
24 ADF RECT			LR UNLK FTIP	6.B	22.1	-2.5	
ZONES	ACCOMODATED TOO FAR	100	AVERAGE WORSE CASE	·· 1.0 -1.5	-1.2 -1.9	2.0 3.3	2.5 4.1
ADJUSTABLE ZONES	LOCATION ACCOMODATED	0	6.8	22.1	-2.5		
	TOO PAR	100	AVERAGE Worse Case	-1.0 -1.5	-1.2 -1.9	2.0 3.3	2. 5 4. 1
BOTH ENDS ZNE3	ACCONODATED TOO FAP	0 10 0					

CAR (1-OPER SAMPLE, 2-CREWSTATION, 3-ACCOM AWAITSIS, 4-REACH ENV, 5-END) --

END OF CAR MODEL

## APPENDIX H

CREWSTATION ANALYSIS-OBSERVER

#### TREMSTRITON ASSESSMENT OF REACH (CAR) HODEL

```
CAR (1-open sample, 2-crewstation, 3-accon analysis, 4-peach env, 5-end) --
  INDICATE WHICH CONTROLS ARE TO BE ANALYZED (0=ALL; N, H=RANGE) --
  1 24
  SAMPLE SIZE (O=ALL; N, NoRANGE) --
     50
  DISPLAY OPERATOR IDS FOR REACH FAILURE (0-HO, 1-YES) --
  RESTRICT SAMPLE BASED UPON MEAS PERCENTILES (0-NO.1-YES) ---
  ENTER LOWER AND UPPER PERCENTILE VALUES --
  5 95
  CLOTHING (1-NONE: 2-5 UNMER: 3-WINTER) --
  ANALYSIS OPTION (1-ALL OPERATOPS, 2-OPFRATOPS ON LOS ONLY) --
  REACH ALGORITHM (1=PASS THROUGH CONTROL, 2-TERMINATE AT CONTROL) --
###OPERATOR NO:
                  1 FALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
                  5 FALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                  6 PALLS OUTSIDE HEAS PANGE *** FOR MEASUREMENT:
***OPERATOR NO:
***OPERATOR NO:
                  7 FALLS OUTSIDE HEAS HANGE *** POR HEASUREMENT:
***OPERATOR NO:
                 11 PALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
                 12 WALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
***OPERATOR #7:
                 13 PALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
: CH ROTARSTO**
                 14 PALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
***OPERATOR #D:
                 15 FALLS OUTSTDE HEAS PANGE *** FOR MEASUREMENT:
***OPERATOR NO:
***OPERATOR WD:
                 22 FALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
                 24 FALLS OUTSIDE HEAS RANGE *** FOR MEASUPEMENT:
:CM ROTARS 40***
CH SOTESTOR
                 28 FALLS OUTSIDE HEAS PANGE *** FOR HEASUREMENT:
***OPERATOR NO:
                 30 FALLS OUTSTOR HEAS RANGE *** FOR HEASUREMENT:
                                                                       10
                 34 PALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
:CM ROTAGEGO***
: CH ROTARSTO+++
                 36 PALLS OUTSIDE MEAS RANGE *** FOR MEASUPEMENT:
                 37 PALLS OUTSIDE HEAS PANGE *** FOR HEASUREMENT:
:CH SOTASMODER
:CH ROTAFHO+++
                 39 FALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
                                                                       11
***OPERATOR #0:
                 40 FALLS OUTSIDE MEAS RANGE *** FOR MEASUPEMENT:
:CN GOTASHGO++
                 43 FALLS OUTSIDE MEAS PANGE *** FOR MEASUREMENT:
***OPERATOR HO:
                 44 FALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
***OPERATOR NO: 46 PALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
```

## CREWSTATION ASSESSMENT OF REACH

SAMPLE: ARMY AVIA TORS FILE:

OPERATOR NOS: 1-50
HEASUREMENT: STATURE PERCENTILE: 5-95

WO OPER ANALYZED: 29 CLOTHING: SUMMER

CREWSTATION: OH-58A COC KPIT-CB5 FILE: HEAS/ST

AUCHORAGE: SEAT

DEP: SEAT BACK:

0.00 3.90 33.03 9.00

LOS ANGLE: -13.0 SEAT PAN: HARNESS:

8.0 50.%

TRACKS: DOWN BACK: 0.00 0.00 0.00

REACH ALGORITHM: TERMINATE AT CONTROL

VISION ACCOMMODATION

	•	IOVR	INE OF	SIGHT	BELOW	
	<b>9</b>	DIST	3	DIST	*	DIST
PORWARD OF DEP BEHIND DEP	0.00	0.00	0.00	0.00 0.00	79.31 20.69	2. 13 0. 32

AVERAGE VERTICAL AND HORIZONTAL DISPLACEMENT FROM DEP 0.19

AVERAGE VERTICAL AND HORIZONTAL DISPLACEMENT FROM SEAT DB 0.00 0.00

PERCENTAGE OF CREVPEDPLE ACCOMMODATED

POSITION TO VISION POINT

0.00

ALL CO	NTROLS	PRIMARY ONLY				
FBIBNCS	ZONE 2R 3	ZONE163	ZONE283			
0.00	0.00	0.00	0.00			
0.00	0.00	0.00	0.00			

REACH CONTROLS VISION POINTERBACH CONTROLS

## CONTROL SUBBARY

			HAND	HARN		LOCATION/ REQUIRED HOVEMENT			
110	CONTROL NAME	₹		LOCK	GPTP	X	7	Z	
1+0	YCLIC ZORES ACCOMODATED	100	D H	UNIK	CLEN	0.0	19.5	11.6	
2+0	COLLECTIVE ZONES ACCORDANTED	100	LII	UNTE	CI.EN	-10.8	17,3	0.0	,
A DJ U	STABLE LOCATION ZONES ACCOMODATED	100		-	10.8	12.5	8.8		

A HY	D BOOS	TSV		RII	UNLK FTIP	19.5	30.0	10.1	
BOTH		ACCOMODATED	100						
		LOCATION ACCOMODATED	10 0		18.5	30.0	10.1		
	RCF TR	TH SW ACCOMODATED	10 0	RH	UNLK EXTP				
		TOO PAR	24						
BOTH	ENDS ZONES	ACCOMODATED							
		TOO PAR	24	AVER	age P case	0.0 -0.1	-0.3 -0.5	0. 2 0. 4	0. 0.
~ na a3	ZONE3	ACCOMODATED	75		-4.0				
antus	TABLE	LOCATION		CAUM	-2.8			v. 4	v.
	70 N 23	ACCOMODATED TOO PAR	75 24	AVER	AGR B case	0.0	-0.3	0.2	0.
6 <b>C</b> 0				LH	UNLK FTIP		30.0		
BOTH	ENDS ZONE3	ACCONODATED	100						
A DJ US	TABLE ZONES	LOCATION ACCOMODATED	100		19.5	30.0	7.1		
5 PU	ML POC	ST SW ACCOMODATED			UNLK EXTP				
		ACCOHODATED TOO FAR	10.0		*********				. 10 =
вотн	PNDS			#U#3	L CRSS	1.3	-4.1	- U . Z	4.
	XON P3	ACCOMODATED TOO FAR	0 10 0	AVER	AGE E CASE	1.1	-2.4	-3.1	2.
	TABLE	LOCATION			-5.5	42.1	-7.8		
u+ L!	T ANT	TORQUE PED ACCONODATED	100	LF			32.6		* ***
		ACCOMODATED TOG FAR	10.0						
BOTH	ENDS			WORS	F CRSE	- 2. 2	D	-0.1	э.
	E3 HCZ	LOCATION ACCOMODATED TOO PAR	0 100	AVER	AGE F CASE	-1.4	-2.9	0.0	3. 5.
A DJ US	STABLE				<b>4.</b> 0	42.1	~7.8		
	ZONE3	ACCONCUATED ANG LINITS	34						
3+R1	T ANTI	TORQUE PED		RF		4.0	32.6	-5.3	

	ZONES	ACCOMODATED	100						
A DJ US		LOCATION ACCOMODATED	100		19.5	30.0	10.1		
BOTH	ZONES	ACCOMODATED							
	T SET				HALK PTIP	17.2	30.0	15.1	
<b>A</b> DJUS	TABLE ZONE3	LOCATION ACCOMODATED	100		17.2	30 - 0	15.1		
	ZONE3	ACCOMODATED			' 				
10 UH	F RAD			RH	UNLK PTIP	7.0	30.0	4.6	
	eg nes	TOO PAR		AV TR WORS	AGE E CASE	0.0 0.0	-0.4 -0.8	0.3 0.6	0.5 1.0
A DJ as	TABLE	LOCATION ACCOMODATED	40		7.0	30.0	4.6		
	2002.3	TOO PAR	31	AVER	AGE E CASE	0.0	-0.4 -0.8	0.3 0.6	0.5 1.0
BOTH		10000000000							
	_	ACCOMODATED TOO PAR	31						
11 VH	F RADI		10 0	RH	UNLK TIP	0.5	30.0	11.1	
A DJ US	TABLE Zone3	LOCATION ACCOMODATED	100		0.5	30.0	11.1		
BOTH		ACCOHODATED						••••	
	ANSPOR			RH	UNLK FTIP	0.5	30.0	16.1	
	WOM E 3	TOO PAR	3	AVER WORS	AGE E Case	0.0	0.0	0.0 0.0	0.0 0.0
		LOCATION	26		0.5	30.0	16.1		
	ZUNES	ACCOMODATED TOO PAR		AVER WORS	AGE E Case	0.0	0.0 0.0	0.0 0.0	0.0
BOTH		ACCOMODATED TOO FAR	96						
13 CL		ACCONODATED	100	RH	UNIK EXTP	12.2	30.0	22. 1	
		LOCATION ACCOMODATED	100		12.2	30.0	22.1		

Root around between the contract the contract the contract tensor between

BOTR	ENDS								
	ES NCS	ACCOMODATED	100						
14 70	VESTE	**************************************					10 1	11.5	34 A
14 16		ACCOMODATED	10.0	Kn	OMPY	BALT	10.1	11.5	36.0
			100						
		LOCATION			1	10.1	11.5	36.0	
	ZON E3	ACCONODATED	10.0						
BOTH	-								
		ACCOMODATED	100						
15 BA	T/GEN	SWS		RH	ONTK	EXTP	8.2	11.5	36.0
	ZON E3	ACCOHODATED							
		ANG LIMITS	3						
A DJ IIS	TABLE	LOCATION				8.2	11.5	36.0	
50 00	ZON B3	ACCOMODATED	96				* * • • •	5000	
		ANG LIMITS	3						
	===								
	ENDS	ACCOMODATED	0.4						
	80 N E3	TOO FAR	3						
			_						
16 RO	# 2 S	W, OVRHD ACCOMODATED		RH	UNLK	EXTE	8.2	9.1	35.0
	ES NCS	ACCOMODATED	55						
		ANG LIMITS	44						
A D.105	TARLE	I-OCATION				8.2	9.1	36-0	
	ZONES	IOCATION ACCOMODATED	55				,,,	5000	
		ANG LIMITS	44						
BOTH		ACCOMODATED	E 6						
		TOO PAR					•		
			-						
17 RO	# 3 SI	, OVRHD		RH	UNLK	EXTF	8.2	7.8	36.0
		ACCOMODATED							
		ANG LIMITS	79						
a D.me	TARIP	LOCATION				8.2	9.1	36.0	
	ZONES	ACCOMODATED	55			~ • •	1	~~~	
		ANG LIMITS	44						
BOTH		10004001555	24						
		ACCOMODATED TOO FAR	20 79						
			, , 						
		r KNOBS		RH	UNLK	FTIP	8.2	5.5	36.0
	ZONE3	ACCOMODATED	58						
		ANG LINITS	41						
A D.1 ne	TARIV	LOCATION				8.2	5.5	36.0	
		ACCONODATED	58			V• 4	.,	JU . U	
		ANG LINITS	41						
BOTH		1000000155	= 0						
	たび おひろ	ACCOMODATED TOO FAR	58 41					•	
			~ 1 						

19 HYD BOOST CIR BK ZONE3 ACCOMODATE ANG LIMITS	D 34	EII	UNLK TTIP	8.2	-2.4	35.0	
ADJUSTABLE LOCATION ZONES ACCOMMENTS AND LINITS	ID 34		8.2	-2.4	36.0		
BOTH ENDS ZORES ACCOMODATE TOO PAR	65						
20 PURL VALVE HANDLE ZONES ACCOMODATE			UNIK CLEN				
ADJUSTABLE LOCATION ZONES ACCOMODATE	:D 100		12.4	14.0	36.0		
BOTH ENDS ZONES ACCOMODATE	D 100						
21 EMER DOOR REL ZONES ACCOMODATE			UNIK CIEN				-
ADJUSTABLE LOCATION ZONES ACCOMODATE	n 100		-9.0	18.3	29.5		
BOTH ENDS ZONES ACCOMODATE	D 100						
22 CAU TEST/RESET ZONES ACCOMODATE	D 100		UNLK EXTP	10.8	18.1	-2.5	-
ADJUSTABLE LOCATION ZUNES ACCOMODATE	D 100		10_8	18.1	-2.5		
BOTH ENDS ZONF3 ACCOMODATE							
23 PH PADIO ZONES ACCOHODATE			UNLK PTIP				
ADJUSTABLE LOCATION ZONES ACCOMODATE	n 100		6.8	17.6	-2.5		
BOTH ENDS ZONES ACCOMODATE	D 100						
24 ADF RECEIVER		KH	UNLK PTIP	6.8		-2.5	
ZONES ACCOHODATE TOO FAR	D 89	AVER	AGE E CASE		-0.2 -0.3		0.4 0.6
ADJUSTABLE LOCATION			6.8	22.1	-2.5		
ZONES ACCOMODATE						٥	n #
TOO FAR	10		age R Cask	0.0	-0.2 -0.3		0.4 0.6
BOTH ENDS					•		
ZONES ACCOMODATE	D 89		,				

TOO PAR

10

CAP (1-OPER SAMPLE, 2-CREWSTATION, 3-ACCOM ANALYSIS, 4-REACH ENV, 5-END) -- 5
END OF CAR MODEL

### APPENDIX I

CREWSTATION ANALYSIS RESULTS OF CONTROL MOVEMENTS

#### CREWSTATION ASSESSMENT OF REACH (CAR) HODEL

```
CAR (1-DEER SAMPLE, 2-CRRUSTATION, 3-ACCOM ANALYSIS, 4-REACH ENV, 5-END) --
  INDICATE WHICH CONTROLS ARE TO BE ANALYZED (G=ALL; N, M=BANGE) --
 10 10
  SAMPLE SIZE (O=ALL; N, M=RANGE) --
  DISPLAY OPERATOR IDS FOR REACH FAILURE (0-NO, 1-YES) --
  RESTRICT SAMPLE PASED UPON MEAS PERCENTILES (0-NO.1-YES) ---
  ENTER LOWER AND UPPER PERCENTILE VALUES --
  5 95
  CLOTHING (1-NONE; 2-SUMMER; 3-WINTER) --
  -- (TIMO 2DI NO ENOTANGE -- ENOTANGE OLIG-1) NOITE ON LOS ONLY)
  BRACH ALGORITHM (1=PASS THROUGH CONTROL, 2-TERMINATE AT CONTROL) --
***OPERATOR NO:
                  1 FALLS OUTSIDE HEAS RANGE *** FOR BRASTREMENT:
                  5 PALLS OUTSIDE MEAS RANGE *** POR MEASUREMENT:
:CH ROTABBGO**
                  6 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                  7 FALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
:CH ROTARROP++
***OPERATOR NO:
                 11 FALLS OUTSIDE HEAS RANGE *** FOR HEASUREHENT:
:cn norkango+++
                 12 FALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
***OPERATOR #0:
                 13 FALLS OUTSIDE HEAS PANGE *** FOR MEASUREMENT:
***OPBRATOR NO:
                 14 FALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                 15 FALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                 22 FALLS OUTSIDE HEAS PANGE *** FOR MEASUREMENT:
                 24 FALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                 28 FALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                 30 FALLS OUTSIDE HEAS PANGE *** FOR HEASUREMENT:
***OPERATOR NO:
: CH NOTANS QU +++
                 34 FALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
***OPTRATOR NO:
                 36 FALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
                 37 PALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
* CH ROTARSGO+++
                 39 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
:CH ROTARSQOPP
***OPERATOR NO:
                 40 FALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
                 43 FALLS OUTSIDE HEAS RANGE *** FOR
***OPERATOR #3:
                                                      MEASUREMENT:
***OPERATOR NJ:
                 44 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
                 46 TALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
***OPERATOR KO:
```

### CREWSTATION ASSESSMENT OF REACH

SAMPLE: ARMY AVIA TORS FILE:
OPERATOR NOS: 1-50
HEASUREMENT: STATURE PERCENTILE: 5-95
NO OPER ANALYZED: 29
CLOTHING: SUMMER

CREMSTATION: OH-58A COC KPIT-PILOT FILE: MEAS/ST ANCHORAGE: SEAT DEP: SEAT BACK:

0.00 3.90 33.03 9.00 LOS ANGLE: ~13.0 SEAT PAN: 8.0 HARNESS: 50.%

TRACKS: DOWN BACK: 12FT RIGHT 0.00 0.00

REACH ALGORITHM: TERMINATE AT CONTROL

### VISION ACCOMMODATION

		I	TO BKI.	SIGHT			
	AI	OVE	ON		BRLO	0 11	
	7	DIST		DIST	» 	DIST	
FORWARD OF DEP	0.00	0.00	0.00	0.00	79.31	2.13	
BEHIND DEP	0.00	0.00	0.00	0.00	20.69	0.32	

AVERAGE VERTICAL AND HORIZONTAL DISPLACEMENT FROM DEP

AVERAGE VERTICAL AND HORIZONTAL DISPLACEMENT FROM SEAT DB

PEPCENTAGE OF CREWPEOPLE ACCOMMODATED

POSITION TO VISION POINT

0.00

ALL CON		PRIMARY Zone 163	
93.10	93.10	0.00	0.00
0.00	0.00	0_00	0.00

REACH CONTROLS VISION POINTEREACH CONTROLS

## CONTROL SUMMARY

			-	TOCALION/		
		HAND HAPN	REQUIRED MOVEMENT			
NO CONTROL NAME	4	FOOT LOCK GRIP	X	¥	Z	
10 UHP RADIO ZONES ACCOMODATED	93	LH UNLK PTIP	-13.3	30.0	5.6	
TOO PAR	6	AVERAGE Worse Case	0.0 0.0	-0.1 -0.2	0. 1 3. 1	0.2 0.2
ADJUSTABLE LOCATION ZONES ACCOMMDATED	93	-12.3	30.0	5.6		
TOO FAR	6	AVERAGE POPSE CASE	0.0	-0.1 -0.1	0.1 0.1	0. 1 0. 1

BOTH ENDS ZONES ACCOMODATED TOO FAR

CAR (1-SPER SAMPLE, 2-CREMSTATION, 3-ACCOM ANALYSIS, 4-REACH ENV, 5-END) -- 5

END OF CAR HODEL

#### CREWSTATION ASSESSMENT OF REACH (CAR) MODEL

```
CAR (1-OPER SAMPLE, 2-CREWSTATION, 3-ACCOM ANALYSIS, 4-REACH EWY, 5-EMD) --
  INDICATE WHICH CONTROLS ARE TO BE ANALYZED (0=ALL; N, N=RANGE) --
 10 10
  SAMPLE SIZE (O=ALL: M.M=RANGE) --
  1 50
  DISPLAY OPERATOR IDS FOR REACH FAILURE (0-NO, 1-YES) --
  RESTRICT SAMPLE BASED UPON MEAS PERCENTILES (0-NO.1-YES) ---
  EWIER LOWER AND UPPER PERCENTILE VALUES --
  5 95
  CLOTHING (1-NONE; 2-SUMMER; 3-WINTER) --
  AWALYSIS OPTION (1-ALL OPERATORS, 2-OPERATORS ON LOS ONLI) --
  REACH ALGORITHM (1=PASS THROUGH CONTROL, 2-TERMINATE AT CONTROL) --
***OPERATOR NO:
                  1 FALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
* CH ROTARBOO ++
                  5 FALLS OUTSIDE HEAS PANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                  6 PALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
                  7 PALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
: CH ROTARBOO+++
***OPERATOR NO:
                 11 PALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
:ca sorusado+++
                 12 FALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
***OPERATOR NO:
                 13 FALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
***OPERATOR NO:
                 14 FALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
***OPERATOR NO:
                 15 PALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
:CR ROTARSOO*
                 22 PALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                 24 PALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
:CW SOTASSOPP
                 28 FALLS ONTSIDE MEAS RANGE *** FOR MEASUREMENT:
:ch sorange++
                 30 PALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                 34 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
: ON ROTARYGO+++
                 36 PALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                 37 PALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                 39 PALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
                 40 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
***OPERATOR HO:
                 43 FALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
***OPBEATOR WO:
***OPERATOR NO:
                 44 PALLS OUTSIDE HEAS PANGE *** FOR MEASUREMENT:
***OPERATOR NO: 46 PALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
```

## CREWSTATION ASSESSMENT OF PEACH

SAMPLE:	ARMY AVIA TORS	FILE:	
OPERATOR HOS: HEASUREHENT: NO OPER ANALTZED: CLOTHING:	1- 50 STATURE 29 SUNNER	PERCENTILE:	5- 95
CREWSTATION: ANCHORAGE:	OH-58A COC EPIT-COPILOT SEAT	FILE:	neas/st

DRP: SEAT BACK: 0.00 3.90 33.03 9.00 LOS ANGLE: -13.0 SEAT PAN: 8.0 HARNESS: 50.% The state of the s

TRACKS: DOWN BACK: LETT RIGHT 0.00 0.00

REACH ALGORITHM: TERMINATE AT CONTROL

## VISION ACCOMMODATION

		LI	NE OF	SIGHT		
	ABOVE		ON	ON		
	×	DIST	٠	DIST	\$	DIST
PORWARD OF DEP	0.00	0.00	0.00	0.00	79.31	2. 13
BEHIND DEP	0.00	0.00	0.00	0-00	20.69	0.32
AVERAGE VERTICAL	AND HO	RIZONTAL	DISPL	ACEMENT	FROM D	EP
-1.74		0.19				

AVERAGE VERTICAL AND HORIZONTAL DISPLACEMENT FROM SEAT DB

# PERCENTAGE OF CREWPEOPLE ACCOMMODATED

POSITION TO VISION POINT

0.00

ALL CO	NTBOLS	PRIMAFY ONLY				
ZONE163	EONE 26 3	ZONE 163	ZONE283			
0.00	0.00	0.00	0.00			
0.00	0.00	0.00	000			

REACH CONTROLS VISION POINTEREACH CONTROLS

## CONTROL SUMMARY

		LOCATION						
		HAND HARN		REQUI	RED HOVE	ement		
NO CONTROL N	AME %	FOOT LOCK	GRIP	X	Y	Z		
							•	
10 UHP RADIO		LH UNLK	FTIP	7.0	30.0	5.6		
ZONES ACCOM	ODATED 0							
TOO F		AVERAGE		-0.9	-1.7	1.2	2.3	
		WORSE CAS	B	-1.5	-2.6	2.0	3.6	
ADJUSTABLE LOCAT	ICA		8.0	30.0	5.6			
MONES ACCOM	ODATED 0							
T00 P	AR 100	AVERAGE		-1.1	-1.9	1.4	2.6	
		WORSE CAS	B	-1.7	-2.8	2-2	4.0	

BOTE ENDS
20ME3 ACCOMODATED
TOO FAR 100

CAR(1-OPER SAMPLE, 2-CREWSTATION, 3-ACCOM ANALYSIS, 4-REACH ENV, 5-END) -- 5
END OF CAR HODEL

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#### CRESTATION ASSESSMENT OF REACH (CAR) MODEL

```
CAR (1-DPER SAMPLE, 2-CREWSTATION, 3-ACCOM ANALYSIS, 4-REACH ENV, 5-END) --
  INDICATE WHICH CONTROLS ARE TO BE ANALYZED (0=ALL: N, M=BANGE) --
 10 10
  SAMPLE SIZE (O=ALL; N, M=RANGE) --
  1 50
  DISPLAY OPERATOR IDS FOR REACH FAILURE (0-NO, 1-YES) --
  RESTRICT SAMPLE BASED UPON MEAS PERCENTILES (0-No.1-YES) ---
  ENTER LOWER AND UPPER PERCENTILE VALUES --
  5 95
  CLOTHING (1-NONE: 2-SUMMER: 3-WINTER) --
  AWALTSIS OPTION (1-ALL OPERATORS, 2-OPERATORS ON LOS ONLY) --
  REACH ALGORITHM (1=PASS THROUGH CONTROL, 2-TEPMINATE AT CONTROL) --
***OPERATOR NO:
                  1 FALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
                  5 FALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
***OPERATOR NO:
                  6 FALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
***OPERATOR NO:
                    FALLS OUTSIDE REAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                 11 FALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
***OPERATOR #0:
                 12 FALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                 13 FALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                 14 FALLS OUTSIDE HEAS RANGE *** FOR HEASURENENT:
***OPERATOR NO:
                 15 FALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                 22 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:
: CH ROTARSOO++
                 24 FALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
***OPERATOR WO:
                 28 FALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                 30 FALLS OUTSIDE HEAS PANGE *** FOR HEASUREMENT:
***OPERATOR NO:
                 34 FALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
***OPERATOR #3:
                 36 FALLS OUTSIDE HEAS PANGE *** FOR HEASUREMENT:
***OPERATOR NO:
                 37 FALLS OUTSIDE HEAS HANGE *** FOR HEASUREMENT:
***OPERATOR NO:
                 39 FALLS OUTSIDE HEAR WANGE *** FOR HEASURENENT:
***OPERATOR FO:
                 40 FALLS OUTSIDE HEAS RANGE *** FOR HEASURENENT:
                                                                        2
***OPERATOR #0:
                 43 FALLS OUTSIDE MEAS RANGE *** FOR MPASUREMENT:
                 44 PALLS OUTSIDE HEAS RANGE *** FOR MEASUREMENT:
***OPERATOR NO:
                 46 FALLS OUTSIDE HEAS RANGE *** FOR HEASUREMENT:
***OPERATOR NO:
```

### CREDSTATION ASSESSMENT OF REACH

SAMPLE: ARMY AVIA TORS FILE:

OPERATOR NOS: 1- 50 MEASUREMENT: STATURE PERCENTILE: NO OPER ANALYZED: 29

SUMBER CLOTHING:

CREWSTATION: OR-58A COC KPIT-OBS FILE: HEAS/ST

A WCHORAGE: SEAT DEP: SEAT BACK:

0.00 3.90 33.03 9.00 LOS ANGLE: -13.7 SEAT PAN: 8.0 HARNESS: 50.%

TRACKS: DOWN BACK: 0.00 0.00 0.00

REACH ALGORITHM: TERMINATE AT CONTROL

VISTON ACCOMMODATION

LINE OF SIGHT

ABOVE BRLOW DIST DIST DIST FORWARD OF DEP 0.00 0.00 0.00 0.00 2, 13 BEHIND DEP 0.00 0.00 0.00 0.00 20.69 0, 32

AVERAGE VERTICAL AND HORIZONTAL DISPLACEMENT PROM DEP

-1.74 0.19

AVERAGE VERTICAL AND HORIZONTAL DISPLACEMENT PROM SEAT DB

0.00 0.00

PERCENTAGE OF CREWPEOPLY ACCORNOBATED

POSITION TO VISION POINT

0.00

ALL CONTROLS PRIMARY ONLY
70NE183 70NE283 20NE183 20NE283
89.66 89.66 0.00 0.00
0.00 0.00 0.00

REACH CONTROLS VISION POINTGREACH CONTROLS

## CONTROL SUMBARY

		HAND HA	PN	L( REQUI			
NO CONTROL WANT	4		CK GRIP	X	Y	Z	
				*****	7		•
10 UHF RADIO		RH UY	LK PTIP	7.0	30.0	5.6	
ZONES ACCOMODATED	89						
TOO FAR	10	AVERAGE	•	0.0	-0.2	0.2	0.3
		WORSE C	ASE	0.0	-0.3	0.2	0.4
ADJUSTABLE LOCATION			6.0	30.0	5.6		
ZONES ACCOMODATED	89						
TOO FAR	10	AVERAGE	:	0.0	-0.1	0.1	0.2
- 2		WORSE C	ASE	0.0	-0.2	0.2	0.3

BOTH ENDS

ZONES ACCOMODATED 89

TOO FAR 10

CAR (1-OPER SAMPLE, 2-CREWSTATION, 3-ACCOM ANALISIS, 4-REACH ENV, 5-END) -- 5

END OF CAR MODEL